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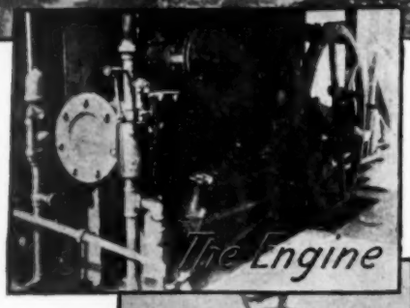

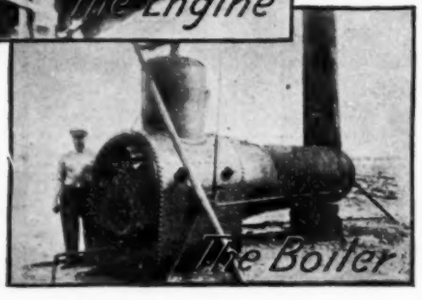

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Say you saw it in The OIL WEEKLY

Unfavorable Position of Refiners Weakens Crude Market

Production is less two weeks in succession; too eager selling by refiners breaks gasoline price at peak of season

By KENT RIDLEY

WITH the Seminole area gradually declining at a rate which indicates possibility of the 450,000 barrel limit set in the curtailment agreement within the next few days, offset in large measure by increases in other sections, the loss for the United States last week was only sufficient to indicate the possibility that the peak for the present has been passed. Whether the agreement or general field conditions are responsible for the decline at Seminole is a matter of opinion, with fluctuations of the different pools and reports of salt water intrusion pointing to the possibility that there could be different constructions put to the statement that "the operators at Seminole 'choose' to limit the output."

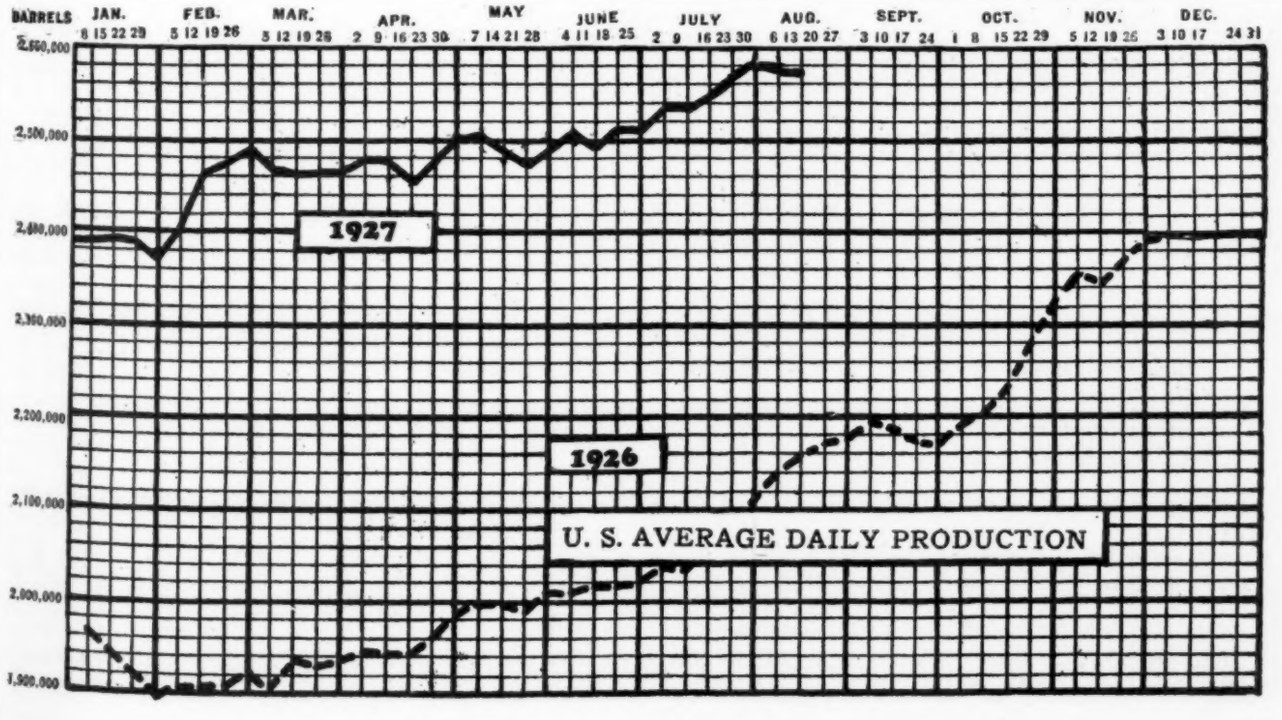
While there is no discussion of crude prices, the unfavorable position of the refiners who apparently have over-played the demand for gasoline, is having a weakening influence. The lower prices in the East are also still having effect upon conditions in California.

The recent break in the Mid-Continent gasoline price structure is having a tendency to weaken the general market situation more than over-production of crude in Oklahoma and West Texas fields. Heavy summer demand for gasoline and fairly firm prices during the past two months have afforded the only bright spot in the picture, and overshadowed the gloom cast by the flood of high gravity sweet oil at Seminole and cheap priced crude in the Panhandle and West Texas districts.

The gasoline peak consumption period usually occurs during August, and a brisk demand continues up through September in all sections. This year is not an exception to the rule, and the reaction suffered lately by gasoline prices is largely due to the dumping of products on the market and causing the saturation point to be reached in some of the larger refining centers. Mid-Continent plant owners were experiencing difficulty in booking new business early this week at 6½ cents per gallon for U. S. Motor gasoline, while a number of sales were made at a quarter or three-eights of a cent below this mark. Gasoline stocks in the North Texas district were reduced about 1,500,000 gallons during the past week through the sale by several plants of this amount of 64-66 gravity export specification gasoline to Sinclair Refining Company for immediate delivery to the latter's export terminals on the Gulf Coast. This high test gasoline was sold for 6½ cents f. o. b. plants, and a considerable portion of it has been stored for weeks in large tanks awaiting a favorable turn in the market.

Oil producers in Mitchell and Howard Counties, located in West Texas, were given a price reduction effective August 15 through the announcement of the Col-Tex Refining Company that its prices in the former county would be reduced from $1.12 to $.93 per barrel. This concern has been running all the oil produced in the Westbrook field, Mitchell County, and providing a steady market. The Westbrook field crude tests between 23 and 26 gravity, but affords a good gasoline yield. Col-Tex has just recently extended its purchases across the county line into the Chalk shallow field, Howard County, where producers have been unable to find a market for their current production, except in a few instances. Col-Tex is making contracts with the Chalk

UNITED STATES CRUDE PRODUCTION TREND



field operators, paying 25 cents per barrel below the Mid-Continent gravity scale of prices which averages about 93 cents per barrel at the well. Col-Tex is enlarging its skimming plant at Colorado, Mitchell County, to handle this increase in current crude purchases. These new prices on Howard-Mitchell County crude are still considerably above the market price available for producers in Crane-Upton, Crockett, Pecos and Winkler Counties, West Texas, where pro-ration is in effect in the flush areas.

Anticipating a flood of new production in the Yates shallow field, located in Pecos County section of West Texas, upon the arrival of Humble Pipe Line Company's eight-inch line now building to the field to take care of both independent operators and major companies, Humble is to work out proration plans among the producers before the line is completed.

Although the daily average production of Oklahoma was 19,100 barrels less during the past week than during the previous week, the decrease for the United States as a whole was only 1600 barrels, the average dropping to 2,575,550 barrels. While Oklahoma declined, the other chief producing States, Texas, California, and Louisiana registered gains.

The decrease in Oklahoma was effected in spite of a gain of nealy 8,000 barrels in the Earlsboro field. Earlsboro's daily average for the week was 202,000 barrels; that of all the other fields comprising the Seminole area combined was only 287,650 barrels, in comparison with 312,100 barrels for the previous week.

The daily average production for Texas during the past week was 612,750 barrels, an increase of 11,350 barrels over that of the week before. This gain was due altogether to West Texas, in which section the increase was 17,800 barrels, the daily average for the week being 163,700 barrels. Every other section of the State registered a decrease in the average daily yield.

California produced during the past week at the rate of 617,700 barrels a day; during the previous week the average was only 612,100 barrels. Louisiana's increase was from 73,000 to 75,750 barrels; with the Gulf Coast section showing a decrease, and the northern part of the State registering a gain of more than 3,000 barrels. The Rocky Mountain States produced about 2,000 barrels per day less during the past week than during the previous week. There was little change in Kansas, Arkansas, and the Eastern States.

The fuel oil situation continues to be the chief source of worry in California. Many of the smaller refineries have had a supply of this commodity and have quoted prices on their distressed stocks which have disturbed but not demoralized the general situation. Regardless of the size of the stocks, the larger concerns are finding an outlet, but at a reduced figure. The demand from visiting ships has increased during the past few months.

The gasoline situation in California remains practically unchanged. Consumption seems to be right now at a peak, with no material decrease expected for some time. The demand from the upper Pacific States has kept pace with the increased consumption in California and Arizona.

No change has been recorded in California crude prices and none is anticipated in the immediate future, unless the matter of over-production in the Mid-Continent fields further irritates the situation. Mid-Continent operators have been gradually making it more difficult for the California operator to profit on his Atlantic Seaboard trade.

Humble Calls Meeting to Consider Proration Plan for Pecos County Production

San Angelo, Texas.—Oil producers and lease owners in the Yates shallow field, Pecos County, depending upon the Humble Oil & Refining Company for a market outlet on all or a portion of future production have been invited by W. S. Farish, president of the company, to work out a proration plan at a meeting to be held in the Houston offices of Humble on August 18. Humble is building an eight-inch line into the Yates field, and at present is the only crude buyer in sight for the field, although the Illinois Pipe Line Company is at work on constructing its third direct line to tank car racks in order to take care of the joint production held in the field by Mid-Kansas Oil & Gas Company and the Transcontinental Oil Company.

The current production from the 13 completed oil wells in the Yates field will exceed the pipe line facilities built and building to the field if the wells were opened up, and a heavy drilling campaign is getting started on the northwest side of the structure as result of recent extensions made to the flush area. The situation requires proration of crude runs by Humble from the start of operation of its line, and the producers are to be given an opportunity to work out an equitable basis for the proposed proration of purchases by Humble.

The following letter has been addressed to all lease owners in the Yates field by Mr. Farish:

"In order that there may be no misunderstanding of Humble Company's position, we write this letter to call attention to the oil situation in the Pecos County area, and to state Humble Company's policy and program as now determined.

"Production in this area is already in excess of market outlet. Humble Company is at present taking a limited quantity through Illinois Pipe Line Company's line to McCamey. We are constructing a 16,000 barrel line from this area to Kemper, which will probably be available about September 1.

"We hope to have our main trunk line from Kemper to Ingleside in operation about October 1. Of this main line, 30,000 barrel capacity will be allocated, under conditions as we now foresee them, to Pecos County production. In view of general over-production conditions, it is our opinion that 30,000 barrels represents the extent of the market for this oil, and we are willing to share this market equitably with the various producers. This will require prorating of purchases on some equitable basis, which will have to be worked out, preferably by a committee of producers affected.

"With this end in view, we will ask that you send a representative to meet with other invited representatives and ourselves at my office in Houston, at 10 o'clock a.m., Thursday, August 18th. This meeting should agree upon details of proration, including, if deemed advisable, the selection of an umpire to facilitate the carrying out of the plan agreed upon.

"We hope that a satisfactory proration agreement will thus be worked out that we can continue, beginning October 1, to market 30,000 barrels daily of Pecos County production with the possibility that this amount may be increased.

"Neither we nor anyone else can foresee conditions far enough in the future to give any warrant as to the length of time that the present situation will continue. It is always our desire to be of the greatest service possible to all producers selling their oil to us.

DETAILS ON CRITICAL FIELDS

Pool—	Oil Wells Completed	Total Initial Production	Initial Per Well	No. Producing Wells	Daily Production Barrels	Daily Production Per Well	Rigs Up	Wells Drilling
OKLAHOMA—								
Seminole District	805	1,079,259	1,340	703	503,231	716	98	433
TEXAS PANHANDLE—								
Hutchinson County	1,049	334,025	509	992	80,790	81	6	73
Gray County	147	43,745	297	150	9,685	64	8	43
Carson County	172	57,285	333	154	9,215	60	8	9
Wheeler County	39	13,950	358	33	2,030	62	2	13
Totals	1,758	649,005	...	1,329	101,720	...	24	138
WEST TEXAS—								
Church & Fields	117	131,275	1,122	112	68,210	609	13	27
Gulf-McElroy	33	37,350	1,132	33	18,225	552	4	15
Totals	150	168,625	1,124	145	86,435	596	17	42
CALIFORNIA—								
Seal Beach	147	203,452	1,384	96	59,500	620	42	55

Lift Efficiency Depends Upon Skill In Design and Operation

Most profitable application of this method of lifting oil is in working deep wells and where production is low

By HARRY PENNINGTON
Mechanical Engineer, San Antonio, Texas

THE air lift, for elevating liquids from wells, is not new by any means; discussions of tests may be found in many treatises, and practically every technical journal has carried air lift for the past 30 years.

If there ever was a mechanical problem based upon empirical data, it is the air lift; there are so many variables, obtained accurately in the field only with practice, that formulae will not be discussed except in a general way, for the writer finds that there are far more incorrect than correct conclusions drawn because of incorrect premises; conditions of service were not accurately obtained and computed results did not agree with actual results and conclusions.

Since the writer prefers to outline a subject for the benefit of the majority of readers, and the majority being field men, complicated formulae will be used only in a general way.

Let it be known here, first, that the performance of gas or air in lifting oil from a well tube is a matter first, of finely dividing the air or gas stream into the smallest bubbles obtainable, and then proportioning the uptake pipe to secure such veolcity as will prevent excessive slippage of bubbles through oil, and at the same time, prevent excessive friction, from too high velocity of air-gas mixture in contact with the well piping; time and again the writer has proven this. All that a foot piece can do toward efficiency is to divide the air or gas into fine bubbles, but, if the uptake piping is too large, or too small, this division into small bubbles is of no avail in securing low cost of plant and low cost of operation.

Foot Pieces

A foot piece cannot correct a poor piping design. A correct piping design can operate at fairly high efficiency, without a good foot piece, but the highest operating efficiencies, and the lowest plant costs are obtained by correct design all the way through, and with this correct design, no installation should fail, whatever the quantity, whatever the lift or depth of well.

Early in the use of air, foot pieces were offered as a means of obtaining high efficiencies, and in a poor installation of piping, adding the foot piece, and correcting the piping design, secured high efficiency. But, removing the foot piece, unless it divided the air stream into bubbles, there was no appreciable difference in efficiency. But with a foot piece dividing the air stream, removing the same affected efficiency materially. So, we have found, after many years, that small bubbles and correct velocity in uptake piping are the two factors of most importance.

When referring to efficiency, let us examine into it—not efficiency itself, but the effect of efficiency. Plant costs for compressor stations are high, per well, particularly in deep wells, and the writer estimates that ten millions of dollars would scarcely cover the cost of stations erected in the Mid-Continent, Panhandle and California within the past eighteen months.

Yet, in no case could the writer find that a reasonable efficiency was being obtained. With an efficiency of 10 per cent, using air, and a cost of compressor plant total, for the industry, of ten millions of dollars, which approximates the total investment in air plant during the past year, an increase of five per cent in efficiency means that 33 1/3 per cent of plant cost would be eliminated, and with an increase of 10 per cent, plant costs are halved, and five millions of capital is then made to do the work of ten millions.

But, with gas from the formation doing work, and the remainder of power furnished from compressors, increasing the duty of formation gas, as well as that of compressed gas, has quite another bearing on plant investment, as will be noted from an example cited further along in this paper.

Factors of Efficiency

The term efficiency includes the duty of formation gas produced with oil, as well as the duty of compressed gas mixed wiht formation gas, for the two quantities are utilized for doing the same work, and while the solubility factor of formation gas and compressed gas differs, still both do work in the proportion of free gas coming up with the oil.

The factors involved in the computation of air and gas lift efficiency are:

Quantity of fluid daily.
Weight of fluid.
Static head.
Working head.
Depression factor.
Size of well casing.
Submergence.
Working pressure.
Size of eduction pipe, or flow line.
Size of air or gas inlet line.
Friction of air-oil, or gas-oil mixture.
Friction of air in down pipe, or gas.
Inlet velocity at bottom of flow line.
Outlet velocity, at top of flow line.
Viscosity of fluid-gas or fluid-air mixture.
Gas content of fluid, or solubility factor.
Quantity of formation gas produced.

DISCUSSION INVITED

In presenting the assemblage of data in this issue on Air-Gas Lift, the editors of THE OIL WEEKLY *have attempted to give our readers practical matter involving, necessarily, the opinions of a number of authorities in the industry.*

A frank discussion on any and all of these articles or parts thereof is invited. Communications must be signed, but if you desire that the discussion be used without your name attached, the communication will be so used.

Any discussion on articles relating to air-gas lift received between now and August 30 *will appear in the September* 2 *issue. Communications should be addressed to—Editor* THE OIL WEEKLY, *Houston, Texas.*

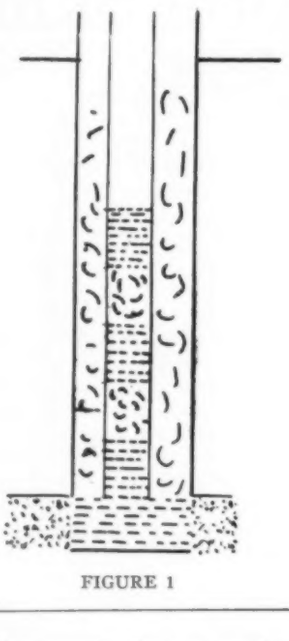


FIGURE 1

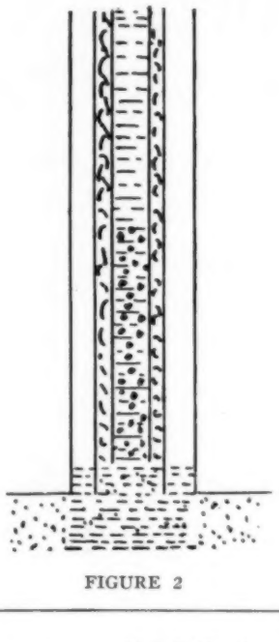


FIGURE 2

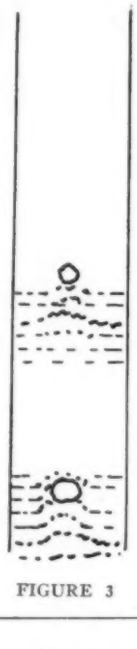


FIGURE 3

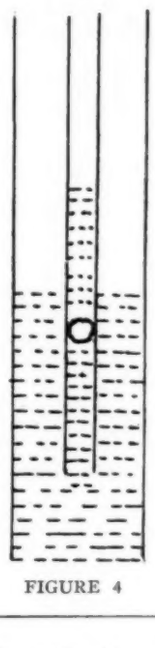


FIGURE 4

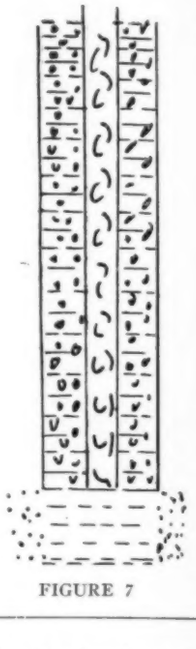


FIGURE 7

Compression loss of gas from condensation.
Slippage of gas or air through fluid in flow line.
Mechanical efficiency of compressor.
Volumetric efficiency of compressor.
Friction losses in gas or air transmission to well.
Heat losses in compression.

In no case has the writer found that each and every one of these factors has been used as a whole in a well installation. In no two wells will any of these found to be the same and hence, each well being an individuality within itself that must be taken as we find it, the layout must be made for that well, without specific reference to any other well.

During the life of a well these factors change, ascending or descending, when the layout itself requires a change. But, striking curves for each well, and projecting these ahead, changes in installation may be made to strike a general average that is ahead of present conditions, so as to anticipate these changes in the well for securing the highest general average.

The advantages of air lift, and the disadvantages are listed below:

Advantages

Capacity—greater than any other known method.
Continuity of operation.
Cleans wells of sands and muck.
Low maintenance cost.
No working parts in well.
Central plant operation.
Greater daily recovery.
Greater ultimate recovery percentage.
Eliminates hazards of rod and tubing pulling and cleaning operations and of swabbing.

Disadvantages

Cost of installation.
Emulsification of oil when well makes water.
Corrosion of casing and well piping when oil and gas contain H^2S.
Paraffin trouble.

Operating Theories

There are various theories advanced as to the operating principle of the air lift; the original Pohle design, as set out in his patent, and in Figure No. 1, discloses the air-piston-water-piston-air-piston principle, or a slug of air and a slug of liquid. While the air lift may be operated in this manner, it has been later proven that intimate mixture of gas and liquid, or air and liquid, shown in Figure No. 2, rather than slugging, affords higher efficiencies; due to the finely divided bubbles necessary for intimate mixture, a greater frictional contact area of gas bubble surface is exposed, and since frictional contact of bubble with oil is the means of lifting, the finer the bubbles, the greater the efficiency.

With a finely aerated mixture, the flow of a well is constant, without surges of either oil or gas, provided of course that the remainder of the problem is correctly solved.

To secure this constant flow, not only must the air or gas be finely divided, but the quantity of air must be proportioned to the liquid, and with this total volume of air or gas, and liquid, the piping up which the mixture travels must be proportioned so that the bubbles are confined and will not slip through the liquid without doing the maximum work. This means that velocity of oil-gas mixture, up the flow line, must be held as high as possible to prevent slippage, so that relative travel of bubbles and of liquid are as close together as possible, yet at the same time, the velocity up the flow pipe must not be so high as to set up excessive friction of gas-oil mixture with pipe wall for friction does not increase as the velocity increases, but approximately as the square of the velocity. For instance, friction, at a speed of five feet per second is increased 16 times by increasing the velocity to 20 feet per second.

Frictional Losses

And, with excessive frictional losses, not of bubbles traveling through liquid, but of the mixture traveling up the pipe, the loss of power for compressing is excessive.

This is illustrated in Figure No. 3, where a single bubble has been released and allowed to travel upward through liquid. This bubble reached the surface, traveling upward by reason of buoyancy, or pressure of liquid on the bubble, and was there simply released. Traveling upward, the liquid was agitated by frictional contact of bubble with liquid, and by displacement of liquid by the bubble and the liquid surface was elevated when the bubble reached it. Thus, the energy contained within the bubble has been dissipated by friction and by elevating liquid slightly, and then lost for further useful work.

But, suppose that we insert a small pipe in the liquid, and release the same bubble within the pipe at the bottom end, as shown in Figure No. 4. Due to the same buoyancy, and to pressure from the liquid outside of the pipe, the bubble travels upward, and filling the pipe, the liquid above the bubble is elevated above the top of pipe. Another bubble will do the same. We find by tests, that this method, while serving to lift liquids, is exceeded in efficiency by the division of the same bubble into many smaller bubbles, as shown in Figure No. 2. Here, the many smaller bubbles traveling upward, lift the liquid surrounding the bubbles, due to frictional contact, and the contact

area being greater, slippage of bubble through liquid is less.

By experiment, the writer has proven that large bubbles travel faster upward than small bubbles, and when traveling faster, develop more friction, but the difference is in favor of many finer bubbles traveling slightly at less speed.

Early Use

From the earliest patents, it seems that Dr. Pohle was the inventor of the air lift, using it first for dewatering mines at Tombstone, Arizona, in and prior to 1886. A contemporary was John Obear, also a scientist, and a developer of the divided bubble principles. The Pohle patents were acquired by a compressor builder and the air lift was exploited under these for many years, successfully.

The first oil field of the Gulf Coast—Spindle Top—owed its huge sustained production to air, beginning in 1901, and air has been in continuous use for 26 years on the Gulf Coast as a consequence, for in no other way can as large volumes of liquid be obtained from such a small diameter hole.

The pioneers at Spindle Top were spurred on by these large recoveries and the old Spindle Top Power Company built a large plant, with "air for hire." Sour Lake followed, then Batson's Prairie, then Jennings, Louisiana, at the Evangeline, or Mamou field, where the largest air plants in the world were operated. Humble followed, in 1904, and since then every Gulf Coast field has had its air period.

Individual operators own these plants. In the earlier days, much air was sold at so much per well per day, or a well was blown for a percentage of the oil —the percentage being based upon production per well and ranging from 10 per cent in a large well, say 7500 barrels, up to 40 per cent in a small well of, say 250 barrels production.

These plants were steam driven, the make of compressor being the Ingersoll-Sergeant, Rand, Leyner and Laidlaw.

Early Air Equipment

Types used were straight line simple non-condensing single steam cylinders with two stage air; twin simple steam cylinders with duplex two stage air cylinders, with flat or piston valves for the steam cylinders and mechanically operated or poppet valves for the air cylinders.

Ordinary oil field boilers made fuel consumption terrific, some plants of this type consuming as much as 3000 barrels of fuel oil daily, but the recovery of oil was enormous and oil was cheap, ranging from 10 to 50 cents per barrel. Frequently, though, a field changed quickly from natural to air, flooded the market with oil so quickly that the market broke, leaving no buyers in the field, making it necessary to construct ground reservoirs of huge size to store large flush.

These plants received the attention of engineers early and details of air were worked out thoroughly both in theory and in practice, with high efficiencies. Some tests made at Evangeline, in 1909, by E. M. Ivens, A. S. M. E., of New Orleans, then of the Ingersoll-Rand Company, and still carried in Kent's Mechanical Engineers Handbook, show fairly good efficiencies for that time, although formation gas is not included in these figures.

The last Gulf Coast field with large air installations was West Columbia, discovered in 1920. One plant has been running there for seven years, using both steam and oil engine driven compressors.

A description of Gulf Coast air practice is given in John Suman's book, written by J. A. Tennant, of Ingersoll-Rand Company, which is interesting and should be referred to for data. This description, however, does not include fundamentals.

The writer having to do with these Gulf Coast fields for 25 years, and having designed and installed many air lift plants and well piping jobs, feels in position to write freely on the subject, and the strangest thing about it is that many field men of the Mid-Continent seem to think that air and gas lift in wells is new.

From all that has been written in the past year about air, every producer knowns that it is on top of the ground, but nowhere do we find an exact discussion of what happens at the bottom of the well.

Conflicting Claims

Proponents of the air lift, or gas lift, set it up as a remedy for all evils; opponents point to water encroachments, damage to wells, failure to operate, cost and so on. But air requires no proponents or opponents; it is old enough and successful enough to stand on its own; properly used, it speaks for itself, and not in a whisper, either.

Since air has finally gotten out of the Gulf Coast and received a fair trial in the Mid-Continent fields and in California, it may be considered now as fixed on the industry; to get your share of flush oil, air is imperative.

Problems of pumping on the Gulf Coast are not exactly like those of the Mid-Continent or of California. Solubilities, due to the difference in quality of oil, are at variance; gas is produced at practically all stages of production in the Mid-Continent, while gas is produced in large quantities on the Gulf Coast, initially, and later there will be no gas of consequence, while large quantities of water show up in the latter fields.

Lifting large quantities of oil and larger quantities of water has been practiced on the Gulf Coast very satisfactorily for 26 years for in no other way could the large flush production of various Gulf Coast fields have been obtained.

Terms used on the Gulf Coast are somewhat unlike those used in other localities, newer in the application of air and gas lift. On the Gulf Coast, we "start" wells and then "blow" them; the Mid-Continent "rocks" wells, and pumps them.

The Mid-Continent has made one improvement that is worthy of note, although this improvement is not generally in use. Practice on the Gulf Coast has been to depend upon compressor displacement as a means of metering air into the well, while in the Mid-Continent and Panhandle elaborate metering stations have been installed in several cases to determine the amount of gas or air pumped into a well, and to determine the total quantity of air and gas or gas delivered from the well, from which the efficiency of the installation may be computed, as well as the ratio of formation gas to oil produced.

While this method is not general, most installations having one to five compressors allotted to each well, the advantages of metering in- and out-going gas far outweigh the cost, particularly where natural gasoline can be made from gas emerging with the oil.

As practiced in the Mid-Continent, piping layouts are simply two-inch, or two and one-half-inch lines let down into the well such distance that the running pressure set up by initial operating pressure, will not exceed the pressure that may be carried on the compressor discharge with the gas engine at full speed and load. As rock pressure subsides, and the working level of oil lowers, the air or gas line is lowered further, followed by the same procedure as rock pressure continues to lower. This method automatically maintains a reasonable back pressure on the sand, and the quality of gas at Seminole, comparatively small anyway, in volume, is not produced with greatly excessive gas-oil ratios.

Power Requirements

Lifting oil from a well is a matter of developed horsepower. To raise one barrel of 38 gravity oil, weighing 282 pounds per barrel, through a vertical distance of 3000 feet requires the expenditure of 26.49 actual horsepower of work, and, if the installation was 100 per cent efficient, then only 26.49 horsepower would be required.

But, since no mechanical device is 100 per cent efficient, the loss must be made up by additional power. At 50 per cent efficiency, the power becomes twice 26.49 or 52.98; at 25 per cent efficiency, four times 26.49 or 105.96, and at 10 per cent efficiency, 10 times 26.49 or 264.49 per barrel.

Thus, at the lower efficiencies, we can see the great increase in power required, for the difference between 10 per cent and 9 per cent efficiency, is 10 per cent of the work required.

But the total power for lifting oil with formation gas included is not all from the compressor plant, for formation gas does work just as the compressed gas does, as note the following example.

Assume a case of:

1500 barrels of 38 gravity oil daily, or 1.041 barrels per minute;
3000 foot working lift;
1,500,000 feet of gas, total, delivered from trap;

750,000 cubic feet of gas from formation
750,000 cubic feet of gas from compressor
less 450,000 feet of gas in solution, evolved in trap, or a 30 per cent solubility factor,
leaving 798 cubic feet of gas for doing work down in the well.
200 pounds working pressure.

The work contained in 798 net cubic feet of gas per minute is 167.58 horsepower, expanding and doing work from 200 pounds down to atmosphere; the work involved in lifting 1.041 barrels per minute 3000 feet is 27.57 horsepower, and the efficiency becomes 27.57

167.58 or 16 per cent. Since the compressor furnishes, in this case, one-half the available energy of the installation, or 83.79 horsepower, the remainder of the power developed is from formation gas.

Now, assume that the efficiency of the installation is increased to 25 per cent, and that the quantity of formation gas is constant. At 25 per cent efficiency, the power required to lift the same barrel of oil 3000 feet is 110.28 horsepower, and since 83.79 horsepower is derived from formation gas, the compressor is required to make up the difference, the power from compressor required is now 26.49 horsepower, as against 83.79 before. Now, adding the solubility loss of 30 per cent, or dividing 26.49 by 70 per cent, the total compressor horsepower becomes 37.84 per barrel, which means that by this method, the size of the compressor plant has been reduced in the proportion of 37.84 to 83.70, or that the compressor plant is now just 45 per cent as large, with 25 per cent efficiency, as it was with 16 per cent efficiency, and, at the same time, lifting costs are reduced in the same proportion.

Doubtless, these figures would never occur exactly in practice, but this illustration is given for the purpose of emphasizing the value of careful, skillful, painstaking design of the highest technique when making a layout for a well. It is not much of a trick to increase the efficiency of gas or air lift—the thing is to do it.

Water well pumping is quite unlike oil well pumping; if the lift becomes too high in water wells, it is quite an easy matter to drill another well and lower the working lift, while in oil well pumping, this method has no place.

In water well pumping, the water and sand is usually replenished by underground flow, and we may pump out of each well only so much as flows past, so as not to increase the lift, but oil wells have no replenishment. What we wish to do in an oil well is to secure the greatest period of sustained production, which means that the highest total recovery percentage is sought, and each well, therefore, is an individual problem by itself and must be handled alone.

When considering the pumping of oil by any method, we still have the problems of conservation of gas and its pressure. If a well is pumped in such manner as to produce the lowest quantity of gas compatible with the largest quantity of oil, which means that gas or air is introduced into the well, it necessarily follows that not only will daily production be larger, but the total ultimate recovery larger, in something like the proportion of introduced gas to formation gas; that is, when introduced gas is used efficiently together with formation gas for pumping.

The use of formation gas efficiently is just as imperative as the use of introduced gas, for the lifting power of both sources of gas is the same per unit of gas, although it serves total recovery percentages to prevent production of formation gas as much as possible in order to hold rock pressures high.

As impressed upon the readers of this journal over the past four years, formation gas is the propelling agent driving oil through a sand to the well bore, and to the surface when the well is flowing natural. When the air lift is used for assisting in lifting oil to the surface, then the quantity of gas that is produced with each barrel of oil may be held to a minimum, although at present it is not possible to hold all formation gas within the oil because of solubility—gas in solution comes out with the oil and may be released when pressure is released, either toward the upper end of flow line in the well or in the trap or tank after the oil has been delivered.

Since the writer originated this line of reasoning in 1918, and set it out later in THE OIL WEEKLY, in the papers referred to, and the industry has generally accepted it as correct, the reader is referred to these papers, as follows:

"Overcoming Paraffin Troubles in Wells," THE OIL WEEKLY, August 11 and August 18, 1923.

"What Vacuum Application Really Does," THE OIL WEEKLY, July 5, 1924.

"Theoretical Mechanics of Flowing Wells," THE OIL WEEKLY, Dec. 12 and Dec. 19, 1924.

The latter paper, in particular, goes into the question of duty of formation gas, solubility, and so on, and for that reason, details of this are not included here.

Piping

As rock pressure subsides, which it inevitably does, should the working pressure of introduced gas or air exceed the rock pressure, trouble starts in a badly designed piping job, for practically all sands are sensitive to back pressures greater than rock pressure.

While it is necessary, for efficient work, to hold as much back pressure on a sand as will secure an equal quantity of oil without excessive formation gas production, still a piping job that sets up losses of pressure that require sending greater pressures down into the well, particularly the deeper wells, should be replaced with a piping layout in which pressures are held within limits that permit operating at the maximum of oil production with the minimum of formation gas production, and minimum of introduced gas.

The use of air lift, or gas, in a flowing well that has such pressure that piping cannot be introduced into the well, is of course impossible, although it would be beneficial at this stage of production to produce as much as possible with introduced gas as a means of holding formation gas in the oil sand for its more valuable duty of driving oil toward and into the well bore.

There is a larger field for air or gas lift in smaller wells, for air will pump a well with 10 feet of fluid in the bottom. It is true that the efficiency of the air lift will be lower in this case, but, as a whole, not so much different from the mechanical efficiency of ordinary pumping methods. Practically all well problems are a matter of compromise anyway, for none of the factors are always ideal—get the oil and get it continuously, even though efficiency may be a little lower. Power costs in pumping small wells is not excessive anyway and with residue gas fuel, or other cheap power, a layout with slightly lower efficiency that maintains an increased production has a greater over-all efficiency.

The cost of an air installation for small wells compares favorably with costs when equipped with customary methods, particularly in flush fields, where usually several kinds of pumping equipment are used in a well before it subsides into a working barrel pumper.

In Northern Louisiana, gas under pressure from gas wells has been used for some time for blowing wells, but the practice is wasteful of gas resources, and State authorities eventually took cognizance and compressors are being installed to use either gas or air.

Air or Gas

Because air works best in a field producing a certain grade of oil, one should not assume that air always best; and because gas, in one case, increased production over that obtained with air, using the same compressor and the same volume, it does not follow that the same will hold true of another grade of oil, for solubility varies with the gas and with the oil, and slippage also varies with the oil.

Slippage of gas is greater than slippage of air in some oils, and the opposite holds for other oils. Naturally, though, slippage is lower in heavier oils than light, and although the heavier oils set up more friction, efficiency of air lift appears to be greater when pumping heavier oils than light.

Where gas has a larger solubility factor than air, air may be best, and where air has a larger solubility factor, gas may be best. It is evident in low boiling point oils, that gas without fractions condensible at moderate pressure is less soluble than in high boiling point oils; and that wet gas is more soluble in high boiling point oils than low. These are but natural laws and

when installing gas lift, or air, use of them may assist in solving difficulties.

Gas has a distinct advantage in fields where the hydrogen sulphide content of oil and gas are high in that corrosion of casing and piping is eliminated almost entirely. It appears, from many tests, that hydrogen sulphide, when agitated with oxygen of the air, in the presence of iron, active chemical action is set up, and so far as the writer has been able to determine, there is no ferrous metal that will resist the corrosive action of hydrogen sulphide together with oxygen on iron. Having made extended investigation into the corrosion of metals by sulphur compounds, the writer has not yet found, in all the long list of anti-corrosive ferrous metals, one that will resist hydrogen sulphide. High chromium steels, wrought iron, pure iron, all yield; gold, silver, copper, aluminum, tin, zinc, lead—all are destroyed, and quickly, and the only answer is that ferrous metals must not be used bare when oil and gas charged with hydrogen sulphide is to be handled with air; that is, this is the only answer so far of which the writer is aware.

Where there is no gas, the carbon dioxide of combustion, from either smoke stacks or gas engine cylinders, when properly treated to remove the corrosive effect of water of combustion, may be successfully used, although the solubility is higher than either air or gas. Even so, the loss of volume due to portions entering into solution, is not so much of a factor as prevents the successful, efficient use of the air lift.

Gas-Oil Ratios

Since the work of lifting oil from a well increases directly with the depth of well, and each cubic foot of formation gas at the rock pressure produced possesses a definite amount of energy, it follows that to deliver a barrel of oil a definite amount of gas is required from which to obtain the energy for driving oil to the surface.

If rock pressure is high, each cubic foot of gas contains more energy than if the rock pressure is low; if the well is deep, more energy and consequently more gas per barrel is necessary.

Therefore, any attempt to arbitrarily fix a ratio of oil to gas that may be produced, is attempting to change natural laws that are already fixed. In a a field 1000 feet deep, the amount of gas at a given pressure necessary to lift one barrel of oil to the surface, is lower by two-thirds than the amount required to lift the same barrel of oil 3000 feet. To say that 500 cubic feet of gas per barrel must not be exceeded would, in the first case, fix the ratio at a greater amount of gas than necessary, while to fix it at 500 feet per barrel at 3000 feet might mean that oil could not be produced without violating that rule.

Consequently, a definite oil-gas ratio, fixed at a definite figure, is not sound engineering. It would be possible, however, to fix the amount definitely for each height of lift, so that each well would necessarily be operated at high efficiency, and in this there would be taken into account the rock pressure under which the gas is produced, the height of lift, the solubility factor, from which the well piping layout could be so designed as to secure the efficiency necessary to come within requirements. Introducing gas, or air, into the well, however, makes the application of a gas-oil ratio rule doubtful, for producers are generally cognizant now of the value of formation gas in driving oil to the well, rather than using it for driving oil to the surface after oil has entered the well, for each foot of gas or air pumped into a well means that its duty has replaced the duty of one foot of formation gas.

Restriction of the Use of Air by Law

All legislation with reference to production of oil, along the lines of conservation, when based upon sound engineering, will undoubtedly succeed. Unfortunately, it is not possible to do by law what cannot be done by the use of applied mechanics. It can be definitely proven that air and gas lifts do increase the percentage of recovery and, since conservation laws, to stand in our courts, must recognize anything that means conservation, air, as an efficient and effective means of production could in no way be legally restricted within itself. In hearing a complaint the Texas Railroad Commission simply said that the complainant should also get an air compressor if he wished his offset neighbor to get no more of his share than complainant.

Refrigerating Effects

The cooling of formation and oil contained in the formation, due to expansion of formation gas as well as evolution of gas in the formation from oil, has been covered previously in a paper of the writer's—"Overcoming Paraffin Troubles in Oil Wells," in The Oil Weekly, August 11 and August 18, 1923. These troubles, as noted, may be reduced by retaining rock pressure as high as possible as long as possible.

Introducing air or gas, when loosed in a well, expands and cools, but when this expansion is above the oil sand it has no effect on the temperature of the sand and the oil in the sand. Only where introduced gas or air is loosed directly opposite an oil sand can there be any refrigerating effect that will affect the sand. In this case, accumulations of paraffin may be greater on the sand face. Unless a well is pumped to bottom, then it is detrimental to run an air line directly to bottom and there loose compressed gas or air that may contact the sand face or the liner; it is best to use an arrangement that does not allow such introduced air or gas to contact the sand face, or to gently heat the introduced air to insure that the temperature is not lowered, or both.

Water

Practically all oil fields go to water when the oil is taken out, and quite naturally, for side and bottom water is the vehicle of oil and gas accumulation, usually surrounding or partially surrounding a field. When the oil and gas are taken out and pressure is removed from the oil and gas formation, water surely follows, whatever the method used for recovering the oil.

If water encroachment occurs in a well pumped with air, then the same well, after delivering an equal quantity of oil and gas in an equal time with any other method of production, whether natural flow or otherwise, would make water.

However, back pressure control eliminates water troubles to a certain extent; wells do not 'cone" with water so badly when back pressure is controlled so as to secure production without lowering local sand pressures too greatly.

Emulsification

This is a principal disadvantage of the air lift. Due to high velocity in the uptake pipe and to striking collars setting up turbulence, intimate mixture of air or gas with oil, also makes an intimate mixture with water should a well produce water with oil. Some oils emulsify more easily than others; the majority of oil produced at West Columbia was, and is still, emulsified, adding the cost of treatment to the total cost of production. Several millions of barrels remained in storage there several years for treating.

But careful attention to details of smooth passages up the well piping, and to securing as low terminal velocities as possible, reduces emulsification.

However, if we can get the oil, the several efficient methods of reducing emulsions at low cost currently used are such that these oils are handled at a profit.

While flush fields may flood the market, as we have noted many times on the Gulf Coast, and now in the Seminole area, with air and gas lift, these fields soon join their settled production comrades, and where a few wells may be pumped to advantage during the flush production, and a greater total recovery of oil secured with low ratios of oil and gas, still the thousands of settled producers offer constructive work in eliminating the mechanical troubles of pumping, cleaning and maintaining them.

These smaller wells are more difficult to handle at a profit, however, when changing over from rods to air, but the many advantages of pumping with air are leading numerous operators to change over now.

Random methods of installation will

not handle small wells efficiently, for, with formation pressure gone, back pressure on the formation is detrimental in that the formation will take gas or air pumped in, instead of delivering gas and oil when the pressure is greater than that of the formation.

The utility of air in pumping small wells is shown in Figures 5 and 6 showing a well in the Somerset field owned by the Frontier Oil Company. Wells on this lease were formerly pumped from a bandwheel power. Today, a single cylinder 8x8-inch Ingersoll-Rand compressor pumps these eight wells without difficulty of any kind, keeping them clean of muck continuously.

Wells of this field produce only a few barrels daily initially and during latter stages an initial production of 20 barrels per day is a good well, and when they settle down to five or six barrels per day they are good wells for the reason that this same five or six barrels per day will be still produced after a long period of years. The oil is of high gravity, produced from a soft sandy shale and owing to slow percolation, this field has sustained its general average per well over many years without marked decline.

From sandy shale, the oil naturally brings in with it muck—shale and sand mixed with oil and paraffin, and cleaning at intervals was necessary. But, since installing air on this lease, production has increased; wells pump continuously without being down for cleaning due to air lift pumping out muck as fast as it enters the well; one man runs the lease; clean out machines have been shut down; rod pulling and tubing pulling has been eliminated; risk of dropping rods and tubing has been done away with, and shutting down pull power, the only operating mechanism on this lease is the compressor and a small gas engine driving it, making the simplest kind of an installation, yet with the greatest overall efficiency, in that the cost of lifting oil per barrel is far lower than before and production is greater.

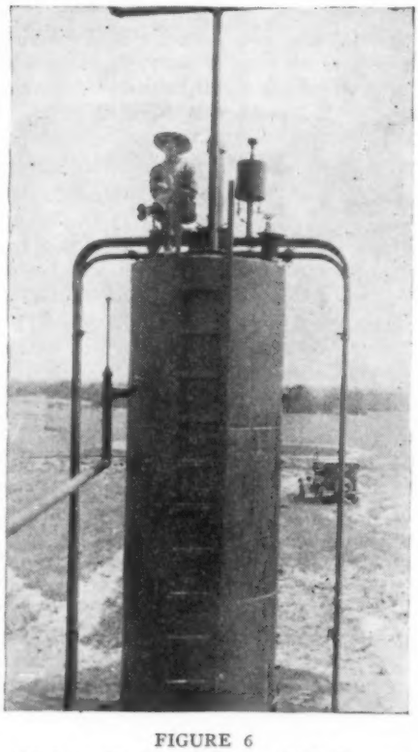


FIGURE 6
Eight well trap, Somerset field, Texas

Special Installation

On this lease, especial valves in the air line, invented and made by Mr. Alexander Boynton of San Antonio, president of the Frontier Oil Company, are located at intervals from the standing surface of oil to bottom of air line for lifting off successive heads of oil to avoid high starting pressures.

These valves, spring operated for closing, are so designed to admit air into the oil 100 feet below the oil surface, and when this 100 feet of oil has been blown off, another valve below then opens, blowing off another 100 feet, followed by closure of the upper valve. This is followed successively down the well until the casing is evacuated of oil, and the well then operates like any other air lift installation.

This in a modification of the Stirling method and of the old Gulf Coast method of starting wells. Rocking is not necessary and is not used and high pressure compressors are not necessary for starting, or operating.

These wells are not pumped throughout the 24-hour day, but appear to deliver equally as much oil, pumped at intervals.

In the writer's estimation, this is the greatest field for the use of air lift—small wells that must be operated at the lowest costs to assure a profit—and no well is too small for air, although where vacuum is employed, air cannot be used, of course.

However, the illustration in Figure 5 shows all there is to a small well on air—surely nothing we know of today could be simpler, and when correctly installed, there is not anything simpler. The easy bends show good practice, although the oil-air mixture is blown horizontally a maximum distance of 1800 feet, to separator, which is not good air practice, but it works on this lease. Wells in this field are 1800 feet deep; oil accumulates to a depth of 400 feet daily in the well shown.

Depression Factor

In any well, oil or water, there exists a depression factor. For instance, in a well 4000 feet deep, with 2500 feet of oil in the bottom when standing without producing, if that well makes 2000 barrels when the working oil level lowers 2000 feet, each foot of head pumped off delivers one barrel of oil per day. If 1000 feet only is pumped off, then only 1000 barrels per day is recovered from a well with a depression factor of one. Provided, however, that the quantity of gas produced with the oil is constant.

This depression factor, applied first by the writer to wells, is an important, if not the most important factor in producing oil, for it is a gauge of the workmanship in finishing a well, a gauge of the productive qualities of the sand in which the well is made, and a gauge of the size of piping necessary in a well to flow it with air or gas.

Submergence has nothing to do with this factor; in fact, submergence is not to be considered as a necessary factor in pumping wells, for, when a well is pumped to bottom, evacuating the casing of oil as fast as oil enters, there is no submergence. Air or gas can do this, as will be seen further along in this paper.

In fields like those of the Seminole area, rock pressure appears to be set up by water from the edges, around the edges, in the upper Wilcox sand, with practically no bottom water in the center of the field in the upper Wilcox, but with bottom water in the lower Wilcox. Therefore, the upper sand

(Continued on page 68)

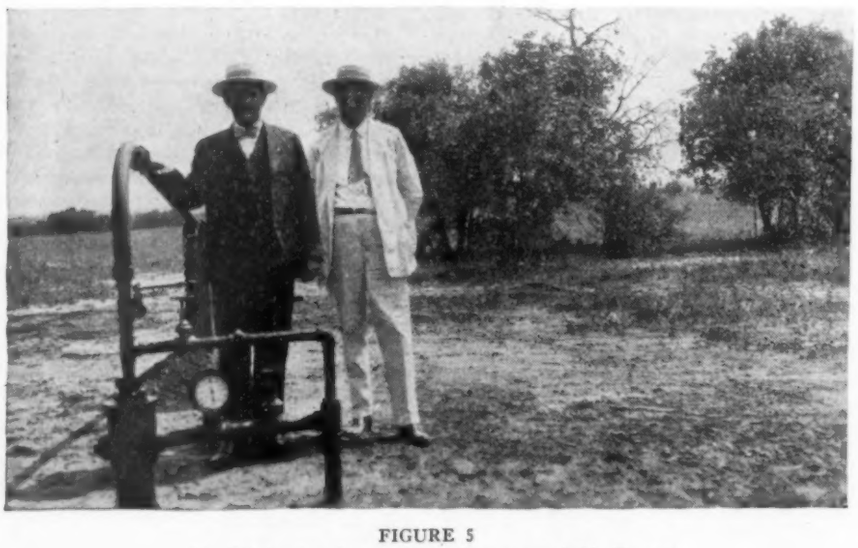


FIGURE 5
Air lift in five barrel well, Somerset field, Texas

Air and Gas Lift Methods and Equipment

By ROBERT N. BURNETT

MUCH has been written about the use of air and gas lifts in the production of oil and the material thus made available has already added considerably to economic operating knowledge. However, a large part of previously published data has been devoted either to theory or individual problems of the installation and practice with no attempt being made to bring together in one compilation a review of the various systems and methods.

Many requests have been received from those engaged in gas and air lift work, as well as those who contemplate such installation, for such information and it is with this in mind that the author has attempted to provide the practical oil man as well as the engineer, with usable information shorn of all non-essential methematics and theory.

All of the data presented, together with the illustrations, has been taken from sections of a book prepared by Mr. Burnett entitled "Handbook of the Gas Lift," which is now on the press.

Mr. Burnett has devoted considerable time to the study of this method of production and is a research and equipment engineer for the Humble Oil and Refining Company.

A COMPREHENSIVE discussion of gas lift practice would naturally be sub-divided into three distinct but interlocking subjects, namely:

Fundamental Theory.

Which would include such considerations as criteria of suitability to gas lift production, determination of productive capacity, determination of proper submergence, flow resistance, losses from slippage and turbulence, effects of elbows and fittings, bases of designs, etc.

Mechanical Installation.

Which would illustrate ways and means of incorporating sound theory in an efficient mechanical plant, model hook-ups, special systems, gas lift equipment, plant layouts, instruments of record and control, etc.

Efficiency of Operation.

Explaining the interpretation of instrument records, conservation of natural supply of gas in the reservoir, adjustments of volume control as indicated by charts to effect maximum efficiency, etc.

Simple Air Lifts

Figure 1 shows one of the simplest forms of air lift hook ups for production through the tubing of a well which makes little or no gas. There are no instruments, gages, or control devices whatever, excepting the pressure gages on the air compressor. The air from the compressor is introduced into the annular space between casing and tubing and the air-oil mixture flows into the open end of the tubing at the bottom and out into an open tank at the surface. The discharge pipe is curved instead of elbowed in order to minimize flow resistance.

Flow is started by "kicking over", or allowing pressure to gradually build up until the level of the fluid outside the tubing is driven down to the predetermined point of submergence of the open end of the tubing, when air begins to percolate up through the column of the oil inside the tubing. As this column of oil becomes more and more intermixed with air, it becomes progressively lighter and consequently rises higher and higher until, finally, it overflows at the surface, providing submergence is adequate.

Pressure in the casing space then drops and becomes constant at a valve which is the final operating pressure for that submergence. The maximum pressure before the well finally kicks off may be twice as great as the operating pressure so that either two compressors, or one having greater capacity than that finally required to produce the well, must be provided when this crude system of starting flow is employed. Moreover, it may take several hours for the pressure to build up until the well kicks over if the submergence is great.

This simple installation is not to be generally recommanded even on wells which produce no noticeable amount of gas because it affords no means of control or improvement except by tedious experiment and is always extravagant comparatively with a scientifically designed and controlled installation.

This is about what the old "blowing" operations amounted to, however, and they produced much oil for less money than could have been recovered by beam pumping. The basic principles are the same for the most crude and the most modern air-gas lift system. The practical difference resides in knowledge of correct submergence and in instruments of precise control.

Figure 2 shows a simple air lift hook-up for production through the casing. Some wells have such great productive capacity that it is not possible to obtain maximum yield through the ordinary sizes of tubing and such wells are necessarily produced in this manner. The discharge pipe in the hook-up here shown is connected by means of a welded "Y" to a casing nipple, thus avoiding a 90 degree bend.

Wells, however, which, make large quantities of sand, corrosive waters, or corrosive gas, should never be produced through the casing even though maximum yield cannot otherwise be obtained. It is better to expend replacable tubing than to destroy casing and thereby court disaster.

Each of these basic hook-up types has an important and legitimate place which the other cannot take, but, in general, it is preferable and it is always safer to employ that one which allows flow through the tubing.

Figure 3 shows a combination of these systems incorporated in a single hook-up. It is the forerunner of the modern two-way and rocking systems later described. Rocking consists in introducing gas alternately through the casing and the tubing to start the flow.

Leaks

Regardless of the type of hook-up, efficiency of operation of the gas lift requires that the maximum volume of gas introduced be put to useful work. Gas tight tubing and casing are therefore of very great practical importance.

If there are leaky tubing joints along the string above the intended level of inlet, gas will pass from the casing space into the tubing through those points and be largely wasted.

Likewise, if there are leaky casing joints, perforations, etc., gas will pass out of the well through such leaks without doing any work at all.

The most rigid precautions must be taken to eliminate all possible leaks because they represent a serious loss of money in any case and they may often entirely defeat the operation of an otherwise excellent gas lift installation.

Casing Heads

Successful gas lift operation requires use of a perfectly sealed casing head. That is, the casing connection must be gas tight; the head must be gas tight, and the tubing must be packed off gas tight. Figure 4 illustrates a few types of heads commonly employed in gas lift installations, among these, type *a* seems to have met with popular favor.

Figure 4-e illustrates a control head

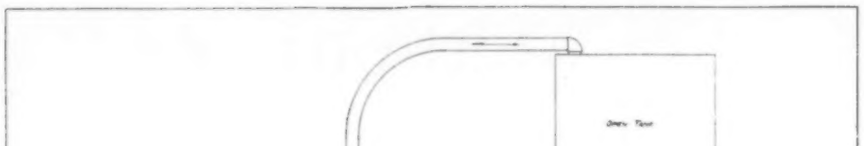


FIGURE 1

which is in wide use and which promises to find increasing favor. It affords a simple means of suspending several strings of casing or liner and controlling pressure between them. It is well adapted to either natural or gas lift flow. Tubing suspended either by threaded connection with the tubing head cap or by spider, and slips, or both.

Figure 5 is a photograph of an installation of this control head at Pampas, Texas. Note the paraffin accumulations. This particular hook-up shows the conventional christmas tree with its crosses, tees and bull plugs which is rapidly going out of style because of the greater efficiency obtained by use of long sweeping curves or gentle bends in the flow line.

Figure 4-g is a casing head designed by Mr. Hollis Porter which reduces flow resistance when production is through the casing.

Model Hook-Up

Figure 6 is Mr. Porter's hook-up incorporating the long sweep head above mentioned. Note tubing spider and slips and provision for the flow through either casing or tubing. Rocking is, of course, also contemplated by this design.

Figure 7 is a hook-up advocated by the National Supply Company. It utilizes casing head (*a*) of Figure 4 and has the feature of a balanced christmas tree with hanger to swing the assembly out of the way when necessary. Plain, open end tubing without foot piece is used. This design also permits rocking to start flow.

Figure 8 is the control scheme for this installation. Note that the layout provides a high pressure kickover line in addition to the main gas supply line. This would not seem to be necessary except in very unusual cases inasmuch as this hook-up allows rocking. A separate casing pressure recording gage is also employed.

Figure 9 is the writer's idea of a good tubing flow installation. It affords rocking facilities and it brings the discharge tubing straight up through a gentle curve to the separator. Two 45 degree curves are sometimes used to avoid the horizontal run. Plain tubing fitted with a perforated nipple or some such foot piece as Figure 14-c is intended.

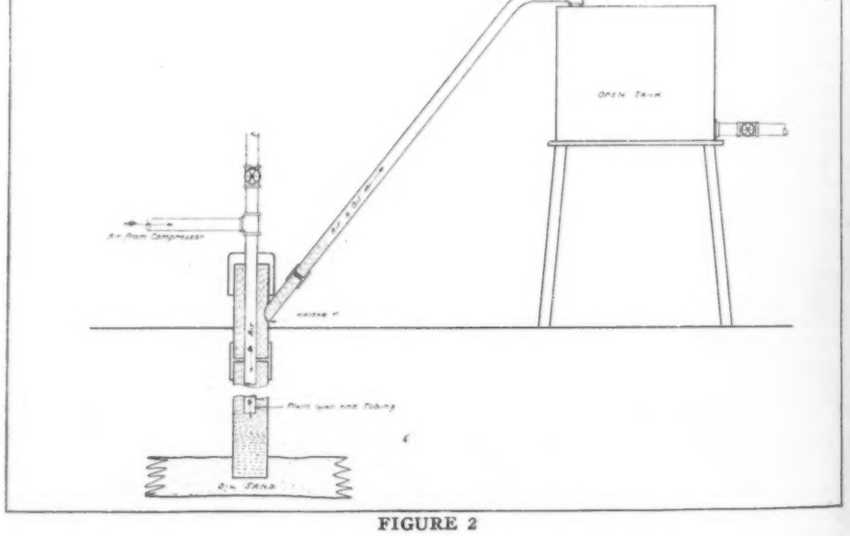


FIGURE 2

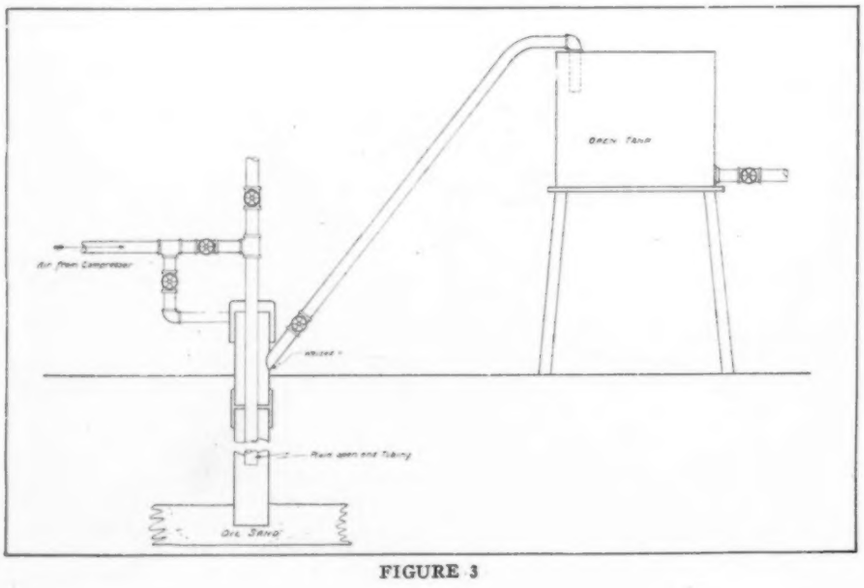


FIGURE 3

Figure 10 illustrates the control system employed with this hook-up. Note that it includes a line pressure recording gage but provides none for the casing pressure as does the National hook-up. This is for the reason that casing head pressure is reflected with sufficient accuracy by the volume control recording pressure gage. The uses of all these instruments are briefly discussed in later paragraphs.

Progressive Submergence Stage Lift

In order to avoid the necessity of maintaining extra compressors, or compressors of high capacity, to start the flow of wells equipped for gas lift, many devices and systems have appeared which have the common purpose of introducing the gas first at levels above the final operating submergence and then, either manually or automatically increasing the submergence until the intended operating level is reached.

Figure 11 illustrates the Taylor system

which has met with some success. Compressed air or gas is introduced through the casing, driving the oil down until the topmost inlet valve or jet is exposed.

A slight differential of pressure between this point and that inside tubing causes the ball in the gas jet to rise and admit gas to the fluid in the tubing. The ball continues to rise as the pressure differential increases, until finally it seats again at the top of the jet and thereafter excludes the gas.

The fluid in the casing space is then forced down to the next jet and the action is there repeated, and so on.

The only objection to this system is that, after a time, the valves become leaky due to sand, paraffin, corrosion or other causes, even if they were gas tight originally, and allow gas to escape from the casing to the tubing at the higher levels and so result in waste of gas and decreased production.

The desirable object of starting flow at nearly the operating pressure may usually be accomplished by the familiar process of "rocking" without resort to progressive submergence devices and so they are not very commonly used.

Perhaps the most successful application

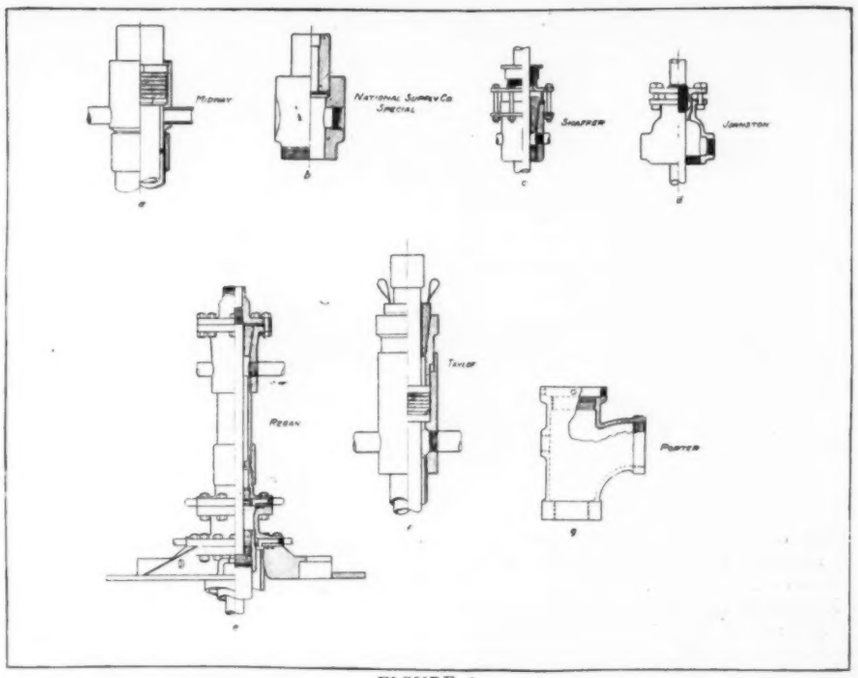


FIGURE 4

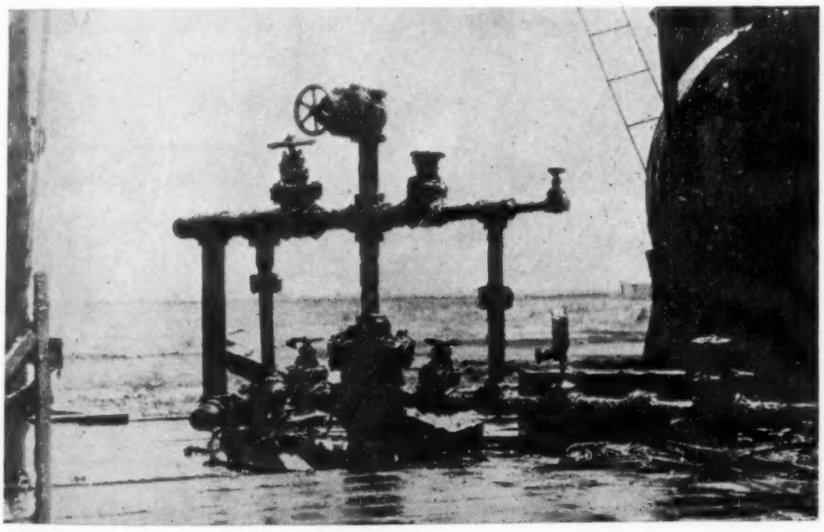


FIGURE 5
Showing Regan Tubing Head installed on Humble Oil & Refining Company's Worley-Reynolds 5, at Pampa, Texas

of the Taylor system has been on small wells flowed by heads: The column of fluid in the tubing is progressively aerated as before explained, but an automatic trip valve at the surface closes the tubing while pressure is building up in the casing. Pressure also builds up in the tubing above the aerated column of fluid. At a certain pre-determined pressure the surface valve trips and suddenly relieves the tubing pressure, thus increasing the pressure differential, causing the fluid level in the casing to drop suddenly and blowing large volumes of gas into the tubing. This quickly cleans the well of oil and when the pressure drops to a certain minimum the surface valve again closes and the process is repeated. Figure 12 is a photograph of the surface hook-up.

Rocking" to Start Flow

Referring to Figure 9 which is considered a first class tubing flow installation, flow may be started with pressure only slightly greater than that which is finally required to produce the well steadily. Proper manipulation of the controls, is given below. Assume all valves originally open, then

1. Close Valve 1 to by-pass separator.
2. Close valves 3 and 5 to by-pass instruments.
3. Let pressure build up equally in casing and tubing.
4. Close valves 6 and 9 to direct gas through line "B" by-pass into casing space. This leaves line "A" open and consequently relieves pressure in the tubing and fluid rises suddenly.
5. Open valve 9 and close valves 7 and 10 to direct flow of gas into tubing through line "A".
6. Open valve 6 to relieve casing pressure through line "B". This causes fluid in casing space to rise suddenly and probably to an abnormal height.
7. Alternate gas flow between casing and tubing until oil flow commences, using only valves 6, 7, 9 and 10. Small valve 12 should be left slightly open to indicate when flow actually starts.
8. When tubing flow is established, open valve 1, and close valve 2, to direct oil through line "C" into separator; open valves 3 and 5 and close valve 4 to direct gas through volume control valve, etc., and close valves 11 and 12.

Recording and Controlling Instruments

The instruments usually employed in a first class gas lift installation include: (See Figure 10 and Figure 13).

1. Recording gas line pressure gage.
2. Pressure reducer with visible gages.
3. Volume control with recording pressure and differential gage, controlled valve, etc.
4. Recording tubing pressure gage.

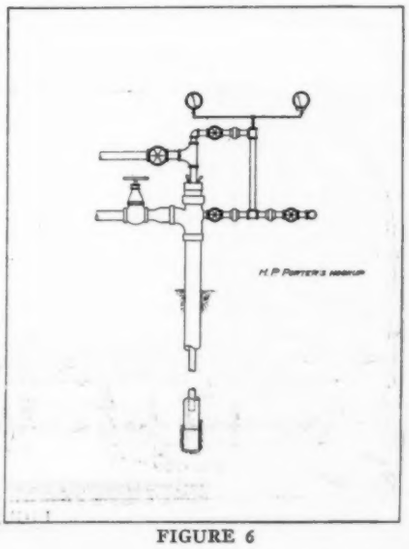


FIGURE 6

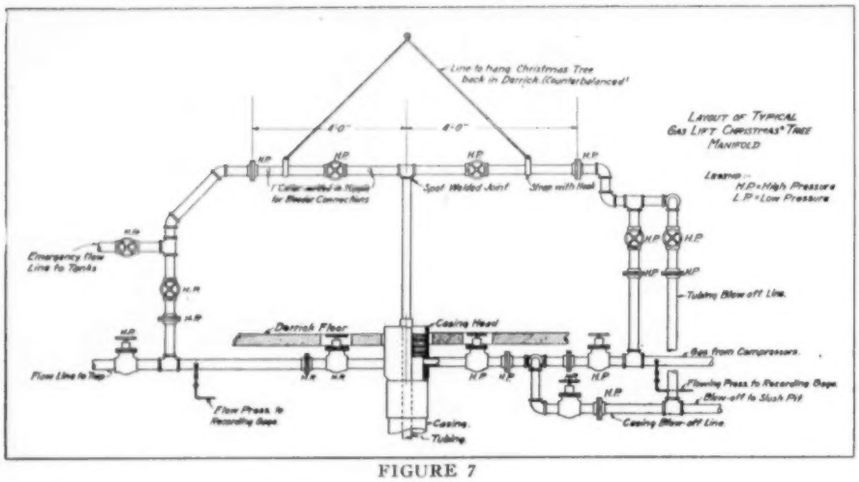


FIGURE 7

5. Return gas meter.

Only one of these, the volume control, has anything to do directly with the operation of the gas lift. The others merely indicate or record what takes place and thereby afford information which assists the operator in adjusting the volume control to obtain maximum efficiency.

Even the volume control, important as it is, is not essential to gas lift production. See Figures 1, 2, 3. These instruments are simply adjuncts to the gas lift which, while they are not absolutely essential, do enable the operator to more efficiently control this method of production, than he possibly could do without them.

Purposes and operation of the various instruments are substantially as follows:

Line Pressure Recording Gage:

To indicate and record pressure in gas line from compressor station so that check may be had on compressor operation and also to insure that pressure rating of lines and fittings may not be exceeded without it being known at the control house. Record of pressure at all times is traced automatically on a time chart.

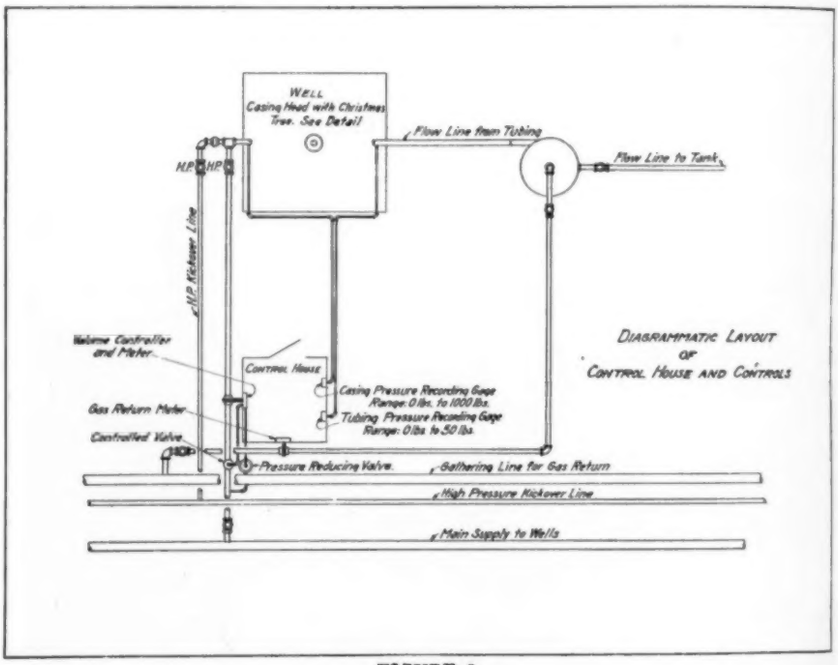

WELL
Casing Head with Christmas Tree. See Detail
Flow Line from Tubing
Flow Line to Tank
H.P.
H.P.
H.P. Kickover Line
Volume Controller and Meter
Control House
Casing Pressure Recording Gage Range: 0 lbs. to 1000 lbs.
Tubing Pressure Recording Gage Range: 0 lbs. to 50 lbs.
Gas Return Meter
Controlled Valve
Pressure Reducing Valve
Gathering Line for Gas Return
High Pressure Kickover Line
Main Supply to Wells
DIAGRAMMATIC LAYOUT OF CONTROL HOUSE AND CONTROLS

FIGURE 8

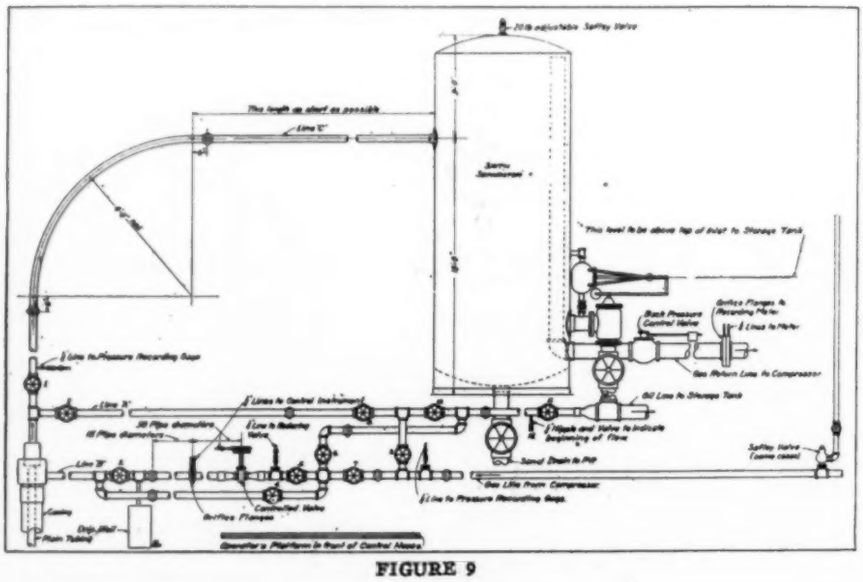

Line to Pressure Recording Gage
Line to Control Instrument
Gas Return Line to Compressor
Oil Line to Storage Tank
Sand Drain to Pit
Gas Line from Compressor
Line to Pressure Recording Gage
Orifice Flanges
Controlled Valve
Operator's Platform in Front of Control House

FIGURE 9

Pressure Reducer.

The object of this instrument is to reduce pressure to about 15 pounds from whatever it may be in the line from the compressor. The low pressure line from this reducer leads to the volume control instrument. Visible gages indicate both the high and the reduced pressure. The instrument most commonly used is an ordinary acetylene tank pressure regulator which may be adjusted by hand.

Volume Control.

This is an assembly of instruments and fittings which includes differential and pressure recording gages and controlling mechanism, whereby a controlled valve in the gas line is made to admit a measured and pre-determined volume of gas to the well regardless of the variation in well pressure. Figure 13 is the assembly.

The control instrument receives low pressure gas from the reducer above mentioned, again reduces the pressure somewhat and passes the gas through a "capacity tank" to the diaphram and so causes the valve to open or close sensitively to changes of well conditions so that a constant volume of gas is always emitted.

Tubing Pressure Gage.

This instrument indicates and records the pressure of the gas-oil mixture in the tubing at the casing head, or the back pressure on the well. Its chief values are its indication whether or not the well is flowing steadily and continuously and its detection of excessive back pressure.

Return Gas Meter.

This instrument measures the volume of free gas returned with the oil from the well. The input subtracted from

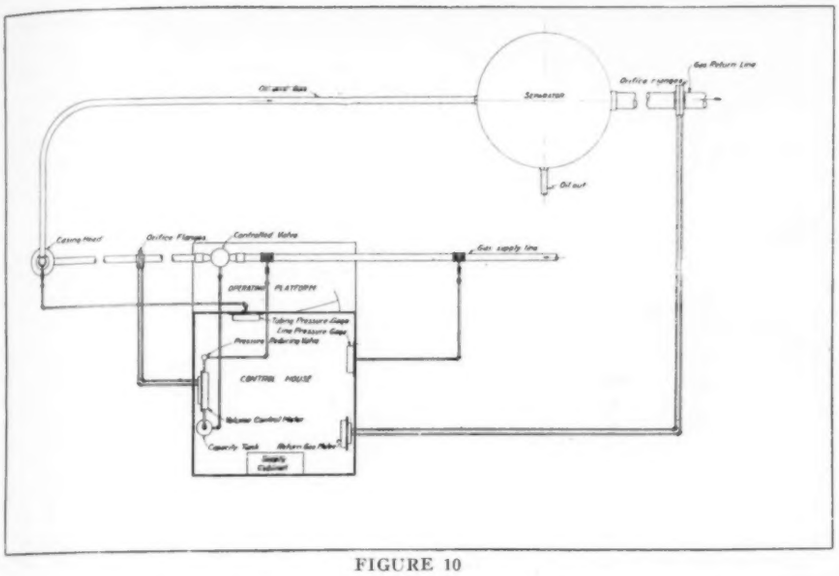


FIGURE 10

this amount indicates the quantity of gas supplied by the well itself. Proper adjustment of the volume control then enables keeping this quantity at a minimum.

Instrument makers supply instruction bulletins which specify in detail how to install, adjust and operate their instruments.

Adjustments to Effect Maximum Efficiency.

Mechanically, the gas lift is operating at maximum efficiency when it produces the most oil with the least amount of gas. It may be, however, that an increase in volume of gas supplied will result in a decrease of gas production by the well itself and from the standpoint of ultimate yield, this would in most cases be preferable to the mechanically more efficient condition.

Moreover an increase in gas volume may substantially increase the oil production and although that increase of gas may be out of proportion to the increased production, the latter may yet be sufficient to justify the poorer efficiency. Cost per barrel produced is the determining factor rather than mechanical efficiency.

The tubing pressure gage affords a good basis for making the preliminary adjustments in most cases. If the chart of this gage is "wavy" and irregular, it indicates that the well is not flowing uniformly. Usually this condition results from a deficiency of supplied gas rather than an an excess, so if the well is started to flowing with the volume control set "wide open," the tubing pressure chart will probably be a smooth circle. Then if the volume is gradually decreased until that curve begins to show a wavy deviation from the true circle, it is known that the minimum amount of gas necessary to cause uniform flow has been passed. More gas should then be admitted until a true circle is again described on the tubing pressure chart. This, then is the minimum volume of gas which will flow the well continuously and with uniformity, and it may prove the most economical and satisfactory amount from all standpoints. Subsequent production records and calculations of gas-oil ratios will indicate what change may have to be made and the direction in which to make them.

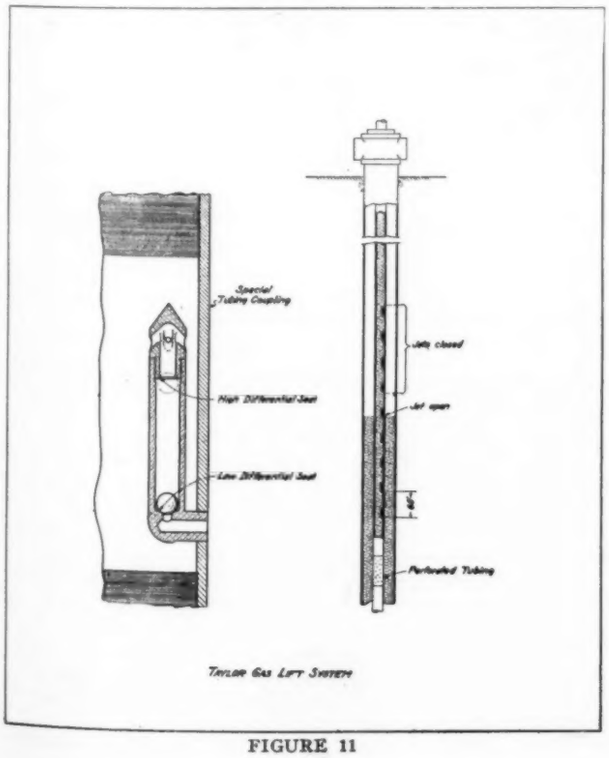


FIGURE 11

Back Pressure Regulation.

An adjustable back pressure valve is supplied with most gas-oil separators as regular equipment and by means of that valve any desired amount of pressure may be maintained in the separator, and consequently, against the well.

Tubing Hangers and Stops

Since it is very often necessary in gas lift practice to alter the submergence, means must be provided for doing so quickly and at will. Several good tubing hangers and catchers are on the market and one of these should be used to suspend the string of tubing in case variable suspension is not provided by the type of casing head used, and another to catch the string in case it parts. They permit immediate and easy elevation or lowering of the string (See Figure 14).

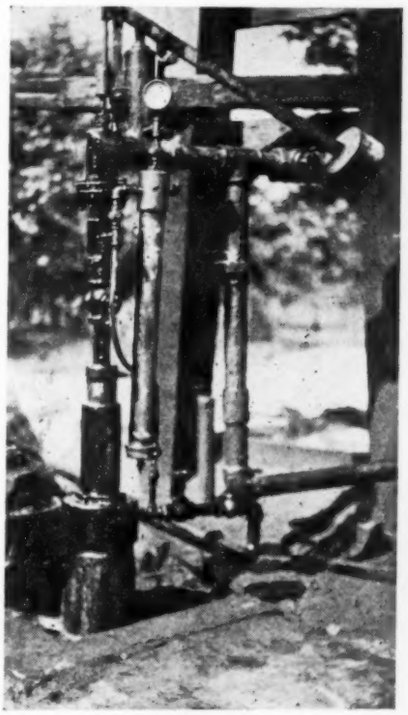


FIGURE 12

The hanger near the top will suspend the string in as nearly a straight line as the limits of the well itself will permit, whereas, if the string is supported exclusively at the bottom, it will assume a sinuous course of many bends due to its own weight above. All such bends are sources of lost efficiency in a gas lift since they promote coalescence of gas bubbles and consequently excessive slippage of gas through the oil. The catcher near the bottom of the string safeguards against dropping the string in case the tubing parts at any point above.

Footpieces

Footpieces are devices attached to the discharge pipe at the point of gas

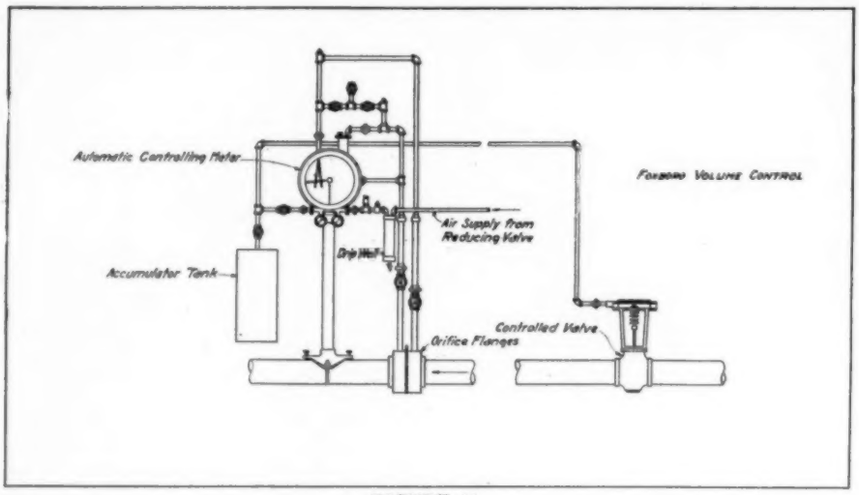


FIGURE 13

inlet usually for the purpose of mixing the gas and oil. Often the inventors of such devices have claimed that exertion of back pressure is entirely avoided, but any such claim is without foundation and impossible of accomplishment.

In general, footpieces do not sufficiently improve gas lift design to warrant their use and in a very great many cases they are actually inferior to plain, open ended tubing. The more assiduously one avoids use of complicated mechanisms and devices in connection with a gas lift, the more successful he is likely to be.

Two footpieces which have met with considerable favor in the West are illustrated in Figures 15-a and b. Many others have there been used with success.

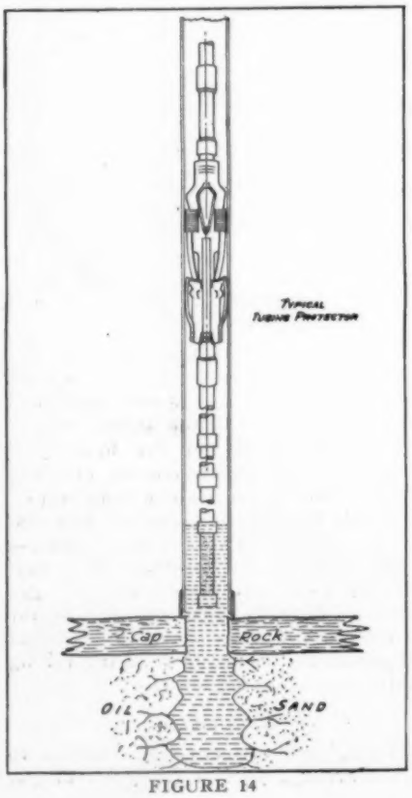


FIGURE 14

Intimate mixing of gas and oil is, of course a condition highly to be desired. The smaller the bubbles of gas at their point of entry into the oil, the more intimate will be the mixture and the more efficient will be the gas lift. Use of a suitable nipple of finely perforated tubing followed by a length of plain end tubing will produce better results than any more complex and costly footpiece yet devised.

Figure 15-c illustrates a simple, cheap and efficient "footpiece" designed on this principle. Obviously, when the oil is forced down below the top row of holes gas passes through them into the column of oil in the tubing and the oil in the space outside the tubing will continue to be depressed until a sufficient number of holes are exposed to allow passage of the pre-determined volume of gas. No further depression of the outside column of oil will thereafter take place. The plain tubing extend some distance yet below this "depressed" level and terminates in a flared or "bell" bottom which allows inflow of oil with a minimum of entrance losses. Spring guides keep the footpiece centered within any usual size casing. Such a footpiece offers no obstacle to the "rocking off" system of starting flow, whereas most others do. Harrisburg Pipe & Pipe Bending Company, Houston, Texas, are makers.

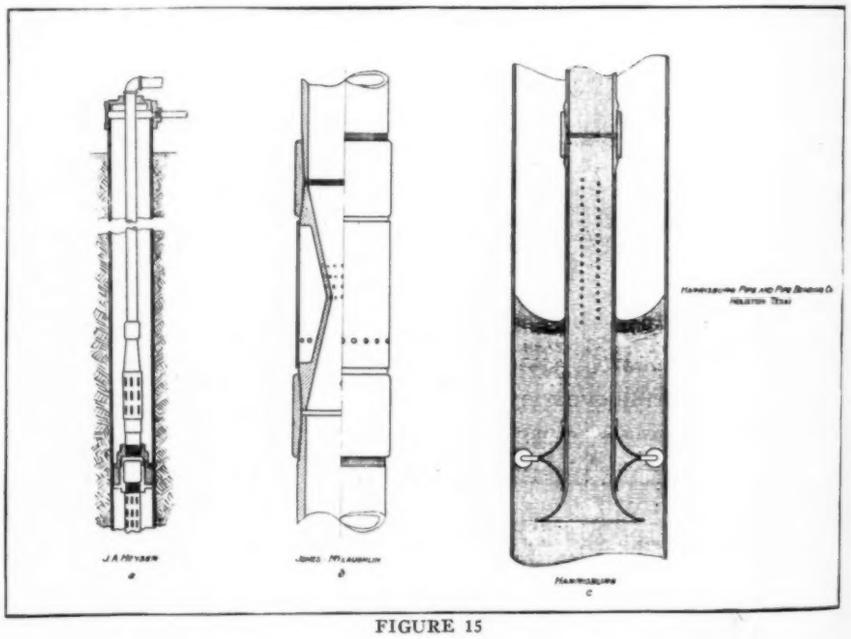


FIGURE 15

Separators

Oil-gas separators are nothing more than cylindrical tanks into which the mixture of gas and oil from the well is discharged so that the two may naturally separate. Baffles are provided to facilitate separation and a float valve operates to maintain a constant level of oil above the bottom of the tank.

This latter provision prevents free gas from escaping into the oil line and affords a head of oil sufficient to assure gravity flow from the separator through several thousand feet of line if the bottom of the separator is about level with final discharge point.

It is practically never an economy to serve two or more wells with a single separator. One to each well, especially selected to handle the gas and oil production of that particular well is long-run economy.

Perfectly good separators are often made from old boilers or gun-barrel tanks and fittings which are no longer usable, but the cost even then of such makeshifts is usually so near that of the finished commercial product that the practice is not often to be recommended.

An excellent type of separator is illustrated in Figure 9. The gas line is contained within the tank, being brought downward from the top to a fixed port and outside connection near the bottom. The back pressure regulator, float assembly, valves, gages, etc., are furnished as a part of the separator.

Ordinarily, no greater pressure

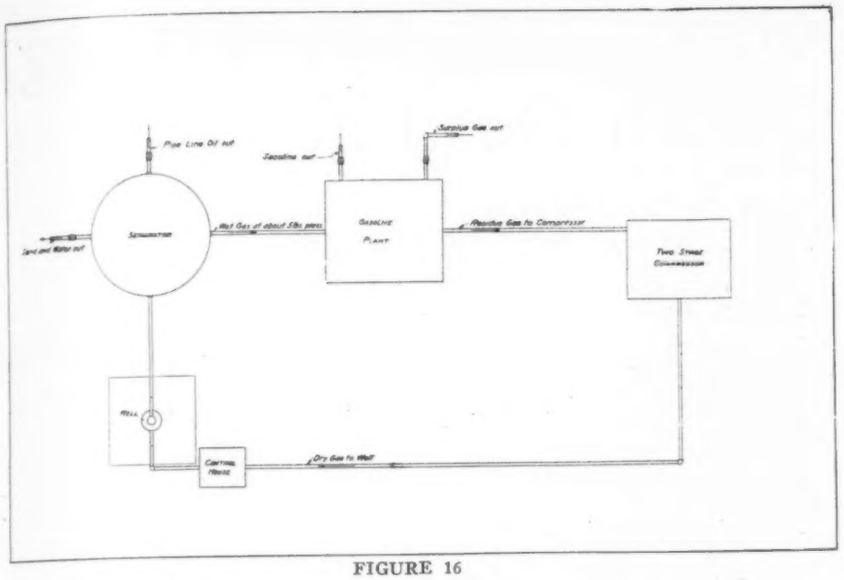


FIGURE 16

should be allowed in the separator than is necessary to force the oil out of it and up into the storage tank, in case the latter is higher than the separator, unless control of oil-gas ratio of the well requires greater back pressure.

It may, however, often prove more economical to maintain enough pressure to pass surplus gas directly from the return line into the sales gas mains, rather than to take such gas out under low pressure, compress it, and then introduce into the mains. Local conditions will have to be studied and experimentation indulged to prove which is the best.

Plant Layouts

Figures 16 and 17 show typical layouts of large gas lift plants, employing central compressor stations, gasoline plant, etc. The one illustrated in Figure 16 employs small portable or permanent gasoline extraction units located at the wells. This scheme requires the holding of a certain amount of back pressure against the wells which is frequently not desirable.

For large scale gas lift production it is probably preferable to employ the scheme of Figure 17 which extracts the gasoline between stages of gas compression and, therefore, does not require back pressure to be maintained against the wells.

In closing, it may be well to drop a thought for the future. For example, in a gas lift design, if it be known in advance approximately what quantity of fluid a given well is capable of yielding from a given depth at a given time, it is a simple matter to select equipment of suitable type and capacity to handle the well's full production, from compressors on down to tubing. Apparatus and method for quickly making such determination of capacity have been evolved by the writer with the able assistance of Messrs. Rex G. Hamaker and F. A. Watts and these will be introduced in the near future, possibly through an article in this publication. Obviously, such information is of great value in selecting wells suitable to gas lift as well as affording a proper basis for the selection of equipment for these and all other wells.

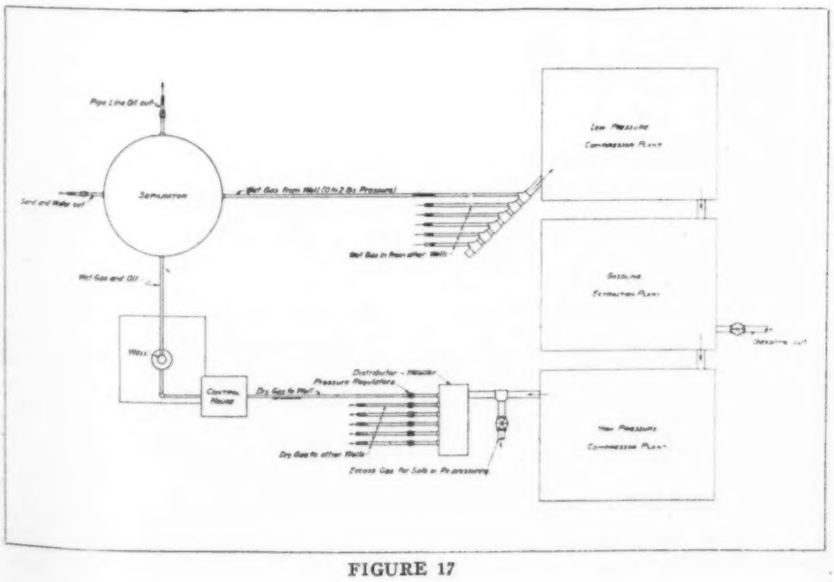


FIGURE 17

Producers Erect 25 More Tanks For Crane County

San Angelo, Texas. — Twenty new 55,000 barrels steel tanks have been purchased by the Landreth Production Corporation, Breckenridge, Texas, for immediate construction on the company's narrow lease lying between the Church & Fields and Gulf-McElroy areas, Crane County. An order for ten of these tanks was placed Saturday, and a duplicate order was placed Monday with a different tank concern. Landreth is completing is first tank building program, which called for 12 55's, and when the new ones are erected the company will have 32 tanks located between producing wells on the lease, which is approximately 400 feet in width and three and eight-tenths miles long. A new tank farm site will have to be purchased should additional tanks be required. Landreth's production from 12 wells on this lease late last week topped the 14,000 barrel mark.

Eastland Oil Company & J. D. Collett-O'Keefe have purchased five new 55,000 barrel tanks to be erected on a newly acquired tank farm site on the east side of the Church & Fields area, having completed construction work on four 55's and a 64,000 barrel tank on the 80-acre lease in the heart of the field. This partnership has set the pace for the field for crude yield per acre, and has a daily output of 11,000 barrels, with two wlels shut down on top of the lime pay for the past month awaiting facilities for handling the oil.

Humble Announces Third Line to Hendricks Area

San Angelo, Texas.—Humble Pipe Line Company is moving in materials to erect two 55,000 barrel steel tanks and a crude gathering system in the Hendricks field, Winkler County. These tanks are to be located in section 8, Public Schol Lands survey, block B-12, and about two and one-half miles south of the field proper. Humble Oil & Refining Company owns the lease on this section of land.

Humble Pipe Line Company has made a survey for a pipe line extension from the Church & Fields area, Crane County, to the Hendricks field, a distance of about 55 miles, and plans to build an eight-inch connection to the latter field as soon as workmen can be released from the Yates field line, which is nearing completion. Humble is the third crude purchaser to definitely announce entrance into the Hendricks field, as Southern Crude Oil Purchasing Company is already serving the field, while the American Petroleum Company, Houston, is building a line from tank car rack to the field, a distance of about 18 miles.

Handling a Small Settled Producing Well With Gas Lift

By C. P. PARSONS

Superintendent, Cement Oil Field and Chicasha Gas Field, Magnolia Petroleum Company, Cyril, Oklahoma.

GAS lift efforts to date have been concerned mostly with good sized production. Another interesting problem presents itself when an attempt is made to economically and efficiently apply gas lift to a seven year old, six barrel pumping well with very little casinghead gas.

The following method of approach is the result of various tests on such a well, 1621 feet deep with 10-inch casing at 1597 feet and oil sand at 1610-1621 feet.

The aim of applying gas lift is twofold, to increase production and to decrease lifting cost. With this well an increase of production was not obtained by gas lift compared with pumping, due to the even inflow of oil from sand into hole. The maximum build up head of the 24 hour, six barrel column of oil in 10-inch 40 pounds casing was 61 feet of 36 gravity oil or 22.2 pounds per square inch. This pressure was not sufficient to cause any appreciable lessening of the rate of inflow against time. Should the inflow have been uneven, with an appreciable lessening as the column built up past a certain point, that point would have been a determining factor as to the location of the jets and for the intermittent operation of the gas lift. That, with a very efficient gas lift installation would have been the basis for increasing production.

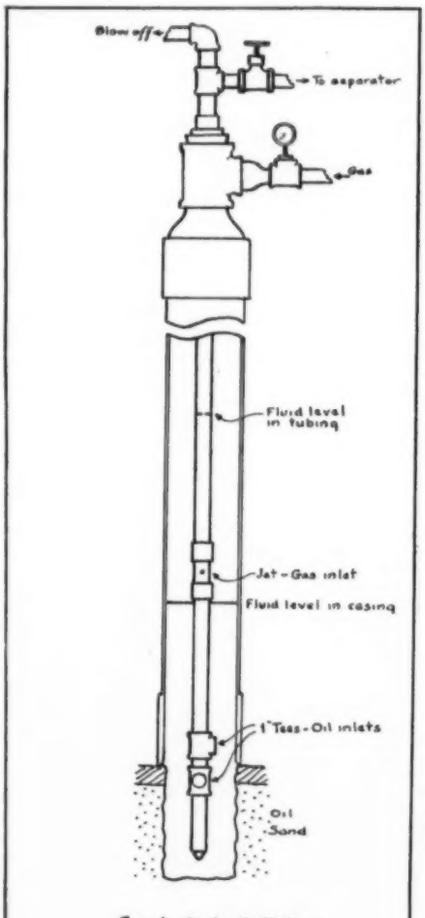
Since increased production was not included in these tests the problem was one of reducing lifting cost per barrel compared with pumping. The oil in this well was clean, therefore, the test did not cover emulsions.

Equipment

One inch, buttweld, 1.68 pound, long collared tubing was used in these tests. A four inch, extra long cast iron plug was converted into a stuffing box by drilling a hole through it sufficiently large for the tubing to go through, and with a recess cut in top in which the top tubing collar is set down on packing to hold pressure between tubing and casing. The jet holes were drilled in short one-inch nipples. A one-inch line connected top of tubing to an experimental oil and gas separator on the derrick floor for determining rate of oil and gas flow. A one-inch lead line was laid to a stock tank. A small compressor was hooked up to supplement the gas line but was unnecessary as we had sufficient pressure and volume in the fuel line. Gas, liquid and pressure reading instruments completed the equipment.

Factors to be determined before tubing is run:

1. Daily oil production while pumping.
2. Gravity of oil.
3. Emulsion, in percent.
4. Water produced, barrels per day.
5. Casing head gas, M cu. ft. per day.
6. Casing head gas per barrel of oil produced.
7. Shut-in pressure of casing head gas at well head.
8. Pressure on sand or "Rock Pressure" (Shut-in press. of casing head gas plus press. due to weight of column of compressed gas plus press. due to column of fluid in hole.)
9. Internal diameter of casing.
10. Internal diameter of open hole.
11. Total depth of well.
12. Depth of oil sand.
13. Condition of hole.



Gas Lift Installation for Small Wells

14. Casing point.
15. Volume of extraneous gas available.
16. Pressure of extraneous gas available.
17. Rate of build up of fluid against time intervals—this is necessary if an attempt is made to increase production based on isothermal expansion.
18. Atmospheric pressure.
19. Oil level, or daily displacement of fluid in 24 hours.
20. Difference in feet between fluid level in casing under shut-in pressure and in tubing open to atmosphere at top.
21. Jet level—should be just above fluid level in casing.
22. Size and number of jets—based on theoretical working pressure at jet level and volume of gas required per barrel of oil.

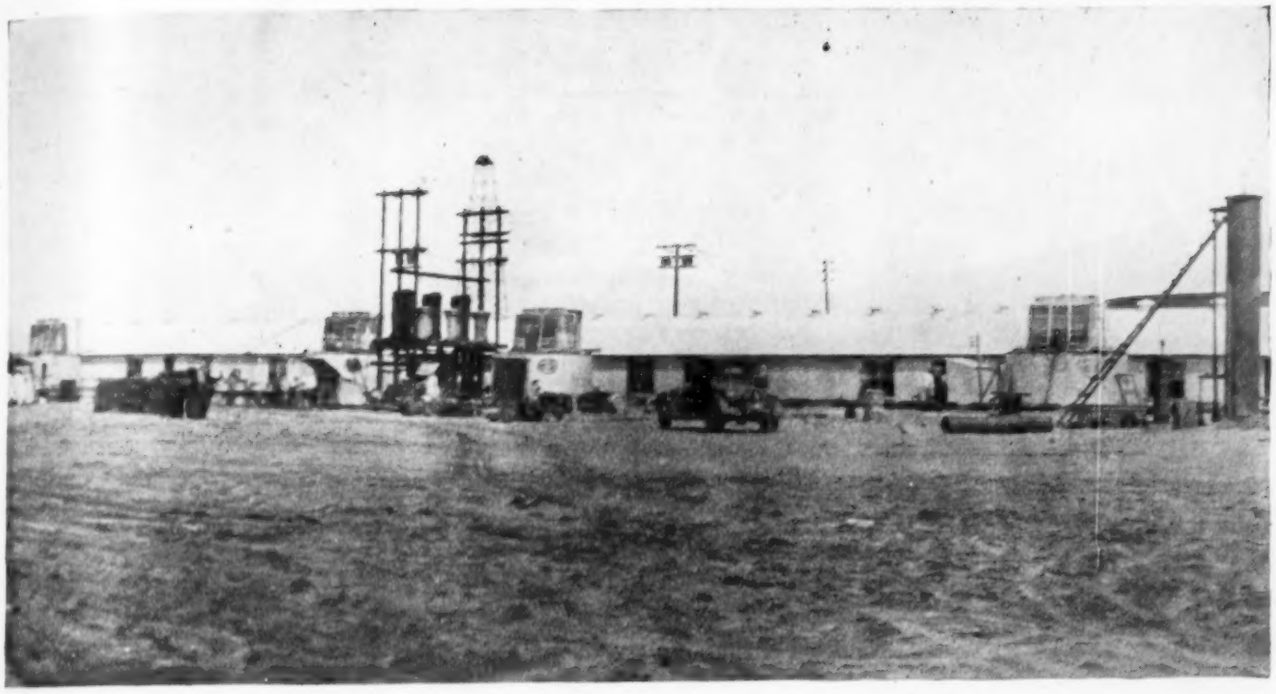
The installations were made based on those factors. Ten feet of anchor plugged at bottom was run on bottom of tubing then two one-inch tees separated by a short one-inch nipple to serve as inlets for the oil.

The gas enters tubing through the jets. Various sized and numbers of jets were used and their relative efficiencies at jet level and oil-gas ratio at well head determined. Efficiencies and gas-oil ratios are entirely relative to local conditions; large jets require more volume of gas and less working pressure which would be necessary on sands that can not stand much back pressure, small jets require less gas and more pressure. The effect of the back pressure on the sand is very important and extraneous pressure should not be applied in excess of rock pressure.

As our well did not produce enough gas to start gas lift extraneous gas was used with an available pressure of 175 pounds. (Recycling of gas with a compression plant will permit a gradual build-up of casing head gas in an old well with very little initial gas volume.)

On the basis of well head gas-oil ratio the most efficient jet in these installations was one one-sixteenth-inch jet, placed just above the oil level in casing, with 175 pounds working pressure on casing at well head. This produced the six barrels of oil at a rate of 48 barrels a day with a ratio of 250 cubic feet of gas (at atmosphere) to a barrel of oil produced.

Four one-sixteenth-inch jets placed at the same level with 160 pounds working pressure lifted oil at the rate of 72 bar-



Landreth's giant air plant, Church & Fields pool, Crane County, Texas

Air and Gas Lift Still Experimental In West Texas

Operation is successful in Church and Fields area, but corrosion and other conditions discourage use at McCamey

By A. R. McTEE
Staff Representative

GAS and air lift in West Texas is just now getting under way. Operations so far have been largely of experimental nature and efforts have been largely confined to test work in an attempt to find out if conditions were right for this method of production. All the companies have been devoting their attentions to discovering what factors can be controlled and to what extent. Consequently air plants have been small, and generally speaking activities have been limited to few weeks. In fact with few exceptions the work done has been on single wells in order to give as accurate control as possible and to enable minute observation.

Operators are convinced from what has been accomplished that air and gas lift can be used successfully in the Church & Fields pool, Crane County, and it is here that a great number of plants are being constructed. One large installation is now running, two others are in process of building, and several other smaller outfits are to be enlarged. When this construction program is completed most of the leases in the field will have air plants, and probably one-half the wells in the field will be on either air or gas.

It is generally believed that the important factors governing production by air or gas lift, can be controlled in the Church & Fields field. Also it has been the common experience that the output of wells can be maintained very near the initial figure, if not actually increased, through the use of air or gas; and records indicate a substantial reduction in the gas-oil ratio on a number of wells.

Much of the data being kept on air and gas wells in the Church & Fields pool, is insufficient to give positive checks. For example, a few companies keep close account of the amount of air or gas put into a well and carefully gauge the output of oil, but do not measure the gas gas content of the oil produced. In such cases, of course there is no information on the gas-oil ratio.

Also some of the methods used to measure the gas content of the oil give only estimates.

Church & Fields

However, with better and more permanent installations of equipment, definite data is being obtained, and the air and gas lift work is being put on a scientific basis. The few companies that have proceeded with this attitude from the beginning are showing other operators what can be done.

Humble Oil and Refining Company's University 5, Church & Fields pool has been on gas two months, the first of August. Its output has averaged 725 barrels of oil per day, with an input foot-barrel ratio of approximately 500 cubic

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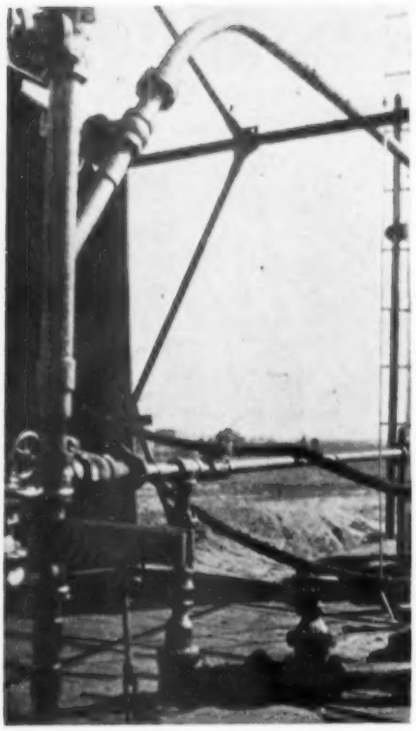
rels a day with a gas-oil ratio of 1040 cubic feet per barrel. The kinetic efficiency of gas bubbles through four one-sixteenth-inch jets is greater than through one one-eighth-inch jet.

Conclusion

The economic indications of the tests showed that it was possible to successfully and economically apply gas lift to this well on the basis of recycling which requires a compression plant or compression gasoline plant using residue for gas lift; that production could not be increased in this well by gas lift alone (the repressuring effect on sand as a whole or in part excluded): that a considerable decrease could be made in lifting cost of this well compared with pumping provided a gasoline compression plant were available or with enough wells like this one to justify a compression plant; that further efforts would be justified on other small wells of different depths and conditions.



Humble hook-up on University No. 5, Church & Fields pool.

feet, and a discharge gas ratio of about 800 cubic feet. Average working pressure is 175 pounds. The well is fitted with three-inch tubing set 550 feet off bottom.

It should be explained however, that the reason for the tubing being set at this level was due to the small compressor. The well could not be kicked off with the tubing at a lower depth. Bigger compressors are now being installed and when they get into operation, the tubing will undoubtedly be lowered in No. 5.

Equipment used to flow No. 5 consists of one Ingersoll-Rand compressor driven by a 100 horsepower Waukesha gas engine. Humble is now installing a high pressure Ingersoll-Rand machine, 9x4½x 10, with working pressure range from 500 to 1000 pounds, and another machine of the same make, 12x5½x14, motor driven. When completed, Humble's plant will have a capacity of 2,000,000 feet of gas.

Hook Up

Input pressure of the gas is about five pounds.

To try to gain further control over the flow of wells, Humble is going to try a graduated string of tubing. The string will consist of two and one-half inch at the bottom; it will be swedged to three-inch, and at the top will be four-inch.

Humble uses the Y hook-up in order to get the benefit of a continuous curve rather than a sharp angle in the flow line. This plan was found to be successful at Seminole.

On No. 5 the separator was set as close to the derrick as possible.

Humble uses a special type manifold for its control apparatus, with an orifice plate in each section. The different sections are tied into the one recorder, so that the one control can be used to test several wells. By by-passing, the control can be hooked to a number of wells, which does away with individual controls for test work.

Humble engineers do not believe that tubing requiring more than 225 pounds working pressure should be used in wells in the Church & Fields pool.

Humble has had little or no difficulty with corrosion in No. 5. Tubing which had been in the well for the two months showed no trace of corrosion, in fact the factory markings could still be read on the string.

Records have been kept on No. 5, for the entire two months and the results plotted. Those in charge of the work believe all the factors are being controlled and that gas lift can be made profitable.

Landreth Plant

Landreth Production Corporation has the largest plant in the Church & Fields district, on its strip lease. This installation is made up of six 9½x4x10 Ingersoll-Rand compressors with starting pressures of 1000 pounds, and continuous operating pressure of 500 pounds. There are also six 11x5x10 compressors with 500 pounds starting, and 300 pounds operating pressure. Short belt and idler drive is used, and the compressors are driven by 75 horsepower squirrel cage, G. E. induction motors.

There is a main air header running the length of the lease, with the plant in the center. Laterals take off from the header to individual wells. The header is telescoped; eight-inch at the plant, six and five-eighths for three locations, and four-inch the rest of the way. Foxboro controls are installed on each lateral. The well hook-up is the National Supply Company's standard Christmas tree, arranged for rocking, with blow-off to the pit. Christmas tree connections are three-inch. Three-inch tubing is used on wells making above 600 barrels; below 600, two and one-half-inch is used, and one 2000 barrel well will have four-inch tubing.

Tidal hook-up with Regan Oil Saver.

A two-inch high pressure line runs to all wells tied into the plant so that several machines can be put on one well to kick it off. This relieves the main header of excessive pressures.

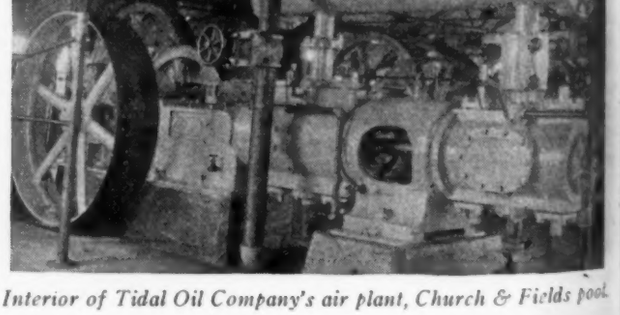
The wells are produced through the tubing.

Below is given the production record on four of Landreth's wells for one day, which is typical for the time the wells have been on air:

Well No.	Flowing pressure	Injected air in cu. ft.	Produc. in bbls.
1	190 lbs.	140,000	525
3	215 lbs.	510,000	1,050
5	185 lbs.	312,000	425
6	180 lbs.	353,000	480

Well No. 8 is flowing direct to storage, with two compressors boosting it at a pressure of 210 pounds. No meter is on

Humble's air plant, University lease, Church & Fields pool.



Interior of Tidal Oil Company's air plant, Church & Fields pool.

Hook-up on Gulf's McElroy lease, Church & Fields pool.

the well. It makes approximately 880 barrels of oil daily. The well flowed naturally for a while after completion, but declined until it finally stopped. Then it was shot, after which it made 600 barrels. After it went dead a second time, it was put on air and has been kept at about 880 barrels since, which is near the initial flow.

No. 3 well was dead when put on the air. It is now making more oil than any other of Landreth's air wells, and is also being held near its initial yield. The first day on air, it made 1200 barrels.

Separators on Landreth's wells are set as close to the wells as possible, and at such height to enable flowing by gravity to the field tanks.

Tubing is set from 30 to 50 feet off the top of the sand.

Production on the Landrth lease has been increased by air, but no check has been kept of the gas-oil ratio. It is planned to equip future wells with apparatus to measure the gas, so that within a short time this company will know the amount of gas conserved.

Starting pressures on Landreth's wells range from 500 to 650 pounds.

Tidal Oil Company

Tidal Oil Company's flowing plant on the University F lease, Church & Fields pool, consists of six 80 horsepower single, four-cycle Western gas engines, belt driven with a short center idler belt drive to 10½x4¾x12 Worthington straight line compressors. These have a discharge capacity of 288,000 cubic feet per 24 hours, at 500 pounds. Compressor speed is 260 r.p.m.

Physical condition of the gas used in the engines gave trouble, but changing the mixing boxes on the engines remedied this.

The plant is being enlarged by six Ingersoll-Rand duplex 11x5x12 compressors, driven by 75 horsepower General Electric induction motors using 440-volt current. These compressors operate at 300 pounds pressure.

Portability is a feature of this extension to the Tidal plant. Inasmuch as production in the Church & Fields area is from lime, there is much conjecture as to its length of life, and the company is building the plant so that its salvage value will be as high as possible. The compressors and motors are being set on heavy timbers and securely bolted.

Pouring concrete in the Church & Fields pool is also expensive, the floor of one small plant costing above $8000, and Tidal believes the new plant will operate as well as if it had the floor.

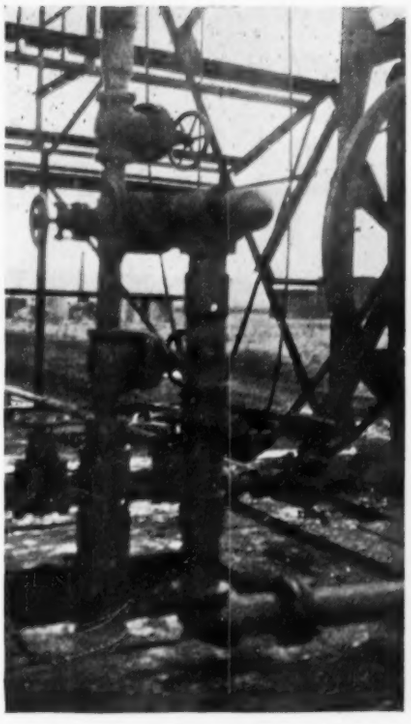
Sand filters are used on both the engines and compressors at the Tidal plant.

No. 2 well on the lease has been on air the longest. When air is taken off, the well stops flowing. It operates at a pressure of approximately 260 pounds. About 220,000 feet of air is required to flow the well. Recently the air volume was boosted to 400,000 feet, with a resulting increase in production amounting to 100 barrels. The gas-oil ratio is about 450 cubic feet. Before putting the well on air, the ratio was 670 cubic feet.

On the same lease, Tidal is flowing wells Nos. 1, 3, 4 and 5 by air. The drop in gas-oil ratio is said to be comparative with that in No. 2. These wells do not stop flowing entirely when air is taken off, but they then flow by heads.

Tidal's control apparatus consists of 500-pound orifice meters on the air lines. To determine whether or not the wells are flowing steadily, a recording pressure gauge is set on the flow line from the well. Gas from the well is measured by the Pitot tube method.

Compressors in Tidal's plant are piped



Hook-up on Landreth's lease, Church & Fields pool.

so that any number can be put on one well.

Starting pressures on the wells run as high as 650 pounds. Worthington compressors are used to kick the well off and they are then switched to the Ingersoll-Rands.

Tubing is run to the top of the sand, but the wells are flown through the casing. It is planned to change to the tubing as the output declines.

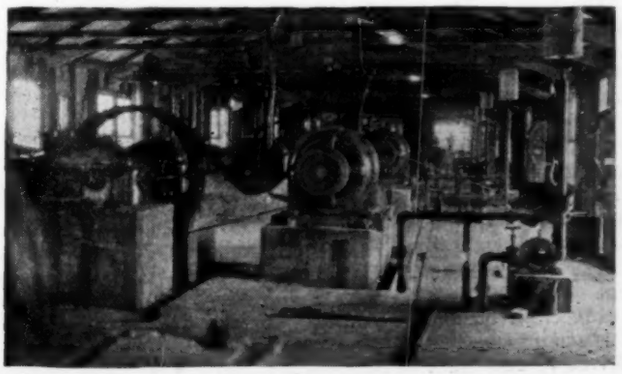
A Regan oil saver is used as a part of the Tidal hook-up.

Average daily production on Tidal Oil Company's University F. lease, Church & Fields pool, Crane County, Texas, for 29 days on air:

Well No.	Production in bbls.
2	1,110
3	1,144
4	1,482
5	1,520
6	1,112
1	1,423

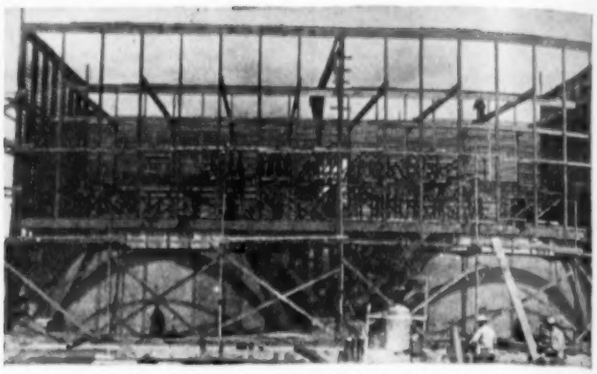
Variation in the output can be seen from the following facts: The first day on air, No. 2 made 1118 barrels. On July

Tidal Oil Company's extension to the Church & Fields air plant.



Interior of Landreth's air plant, Church & Fields pool.

Marland's Diesel plant, McCamey field.



Water cooling plant for Eastland's air plant, Church & Fields pool.

20, the output from this well was 1153 barrels. Well No. 3 started off at 1238 barrels, but gradually declined until the yield was 843 barrels when air was taken off, July 20, on account of proration in the amount of oil bought by the purchasing company. Well No. 4 started at 1657 barrels, but had dropped to 1200 barrels when proration went into effect. Other declines were about as shown in the wells listed.

Paraffine trouble was undoubtedly responsible for some of the slump in these wells, inasmuch as Tidal is flowing through casing.

Well No. 4 is a good example of the possible recovery by allowing the wells to flow: Maximum production of this well flowing by heads was 908 barrels, against 1200 barrels on air, giving nearly 300 barrels gain through the use of air.

Simms-Atlantic

University No. 2A, on Simms-Atlantic property, was put on air April 22. Production at that time was 1575 barrels of oil, with a gas-oil ratio of 1500 cubic feet per barrel. By April 25 the ratio had decreased to 348 cubic feet, exclusive of the air put in. There had been a simultaneous gain in output and the well was making 1680 barrels. By May 2 the yield was 1720 barrels.

Hourly gauges on this well showed that at the end of seven hours after air was taken off, the well was practically dead, showing positively the benefits obtained by air.

On account of too large a cross-sectional area, in other words, too large tubing, as well pressure went down a decided production decline was suffered and the gas-oil ratio again approached the 1500-foot figure.

The tests on this well demonstrate the importance of the proper size tubing. By changing the size of tubing, the heavy slump might have been avoided when the well was taken off air.

Simms-Atlantic have made important experiments on the depth of submergence, amount of back pressure, and the size of tubing, in the Church & Fields pool, and have had sufficient success to show the advantages of gas or air lift there.

The Simms-Atlantic plants consist of one on the University "A" lease with two 10x3¼x12 Worthington-Laidlaw horizontal semi-portable type air compressors driven by two Clark drilling engines, and one on the University "D" lease with one Clark Brothers vertical compressor, model 137, direct connected to a Clark vertical engine.

Gulf Production Company

The Gulf Production Company operates four Clark 80's on its McElroy lease and this plant will probably be increased by two 160 twin compressors soon. On the Lassiter lease, north side of the field, the company has two Clark 120's driven by Clark drilling engines.

McElroy 1 had been on air about a month, the first of August, and had averaged 400 barrels of oil daily. Injected gas amounted to an average of 300,000 cubic feet daily. Operating pressure was 150 pounds. Average intake pressure of the gas is about six pounds.

McElroy 18 had been on gas about one week at the time this check was made. It had produced 500 barrels by heads, but jumped to 650 barrels steady when put on gas.

On the Lassiter lease, the one well being boosted required 400,000 feet of air and produced an average of 500 barrels of oil.

Tubing in McElroy 18 is 50 feet off the bottom, and the well is being producer through open end tubing, three-inch. No. 11 on the Lassiter lease uses the same size tubing set 80 feet off bottom.

The Gulf has not kept check on the gas-oil ratio. Production records show increases in output on the wells, however. This company is also making comparisons between the amount of gas required and the amount of air. Being able to use the intake pressure of the gas gives an advantage over air, but the sulphur content of the gas involves other complications that have not been overcome.

Eastland Oil Company

Eastland Oil Company has had in operation, for a short time, a plant which consisted of three Clark drilling engines connected to Clark compressors. Results secured by this plant were sufficient to justify the building of a larger one, and the company now has under construction a new unit which will have eight 90 h.p. Clark engines direct connected to tandem compressors. Capacity of this plant will be about 860,000 cubic feet per hour. The engines will burn gas. Eight wells will be operated from this plant.

A special feature of the Eastland plant is its water cooling tower. The tower has individual spray units for each compressor unit, and is 20 feet high by 32 feet wide by 64 feet long. Water will be sprayed through 108 Thompson sprays and will fall back on the air coils. Capacity of the water plant will be 1100 gallons per minute. The water supply will come from three wells in the field.

A special design high-pressure manifold is another feature of the plant. This will by-pass the air pressure from any compressor unit to any well on the lease. There will also be meters, regulators, and by-passes between the high pressure manifolds and each well.

The wells are to be blown through the casing.

The installation is being put in by the Forest E. Gilmore Engineering Construction Company, Tulsa, under the direction of H. A. Harmon.

Not Successful at McCamey

Experience at McCamey, Upton County, has been that air or gas lift is not successful because of the low fluid content of the wells. Several small outfits have been tried out, including a number of portable compressors, but few have been kept in operation.

Marland has one well on air, operated by a Chicago Pneumatic compressor direct connected to a Diesel engine, 80 horsepower. This outfit operates at 500 pounds pressure, 300 cubic feet of air per minute. Kerosene is used for fuel.

The well operating from the Diesel installation is tubed to 1200 feet with the last 12 feet perforated. A pressure of 400 pounds is required to start the well, but it operates at about 175 pounds. Well pressure averages 20 pounds. About 225 barrels of oil is obtained, to 1125 barrels of fluid. It is estimated that production has been boosted 75 barrels. Actual depth of submergence in this well has not been determined, but the hole stands nearly full of oil and its total depth is 2098 feet. Three-inch tubing is used.

This is the first Diesel installation in West Texas, and it has been in operation for too short a time to compile any figures on its cost, efficiency, etc., but Marland feels that it will give results to justify itself.

Roxana Petroleum Corporation has a small plant on its Bowen lease, McCamey

(Continued on page 82)

Seminole Production Decline Shows Shut-Down Is Working

Production Tuesday nearing mark set by agreement as limit; salt water in many wells may have some part

By GEORGE REID
Staff Representative

TULSA. — Apparent effectiveness of the proration or curtailment program in the Greater Seminole area has been manifest over the week end by a decrease in total production from 503,231 barrels the morning of August 13, to the production figure Tuesday of 455,495 barrels. Production in the Seminole area over the week end was as follows:

District—	Sunday 7 a. m.	Monday 7 a. m.	Tuesday 7 a. m.
Seminole City	74,335	75,463	75,648
Bowlegs	168,684	167,578	167,891
Searight	28,039	28,502	27,888
Earlsboro	192,510	183,970	175,648
Little River	9,162	8,484	8,420
Total	472,730	463,997	455,495

Thus far the proration program has caused the decline of production to come within about 6000 barrels of the proposed allowed production of 450,000 barrels, and there is every indication that this figure will be secured in the next few days, for operators in the field are co-operating nicely in their efforts to reduce the flood of oil in the area.

Interesting Outlying Operations

T. B. Slick's wildcat test in section 1-6-6, seven miles south of Indian Territory Illuminating Oil Company's Little River producer, is running higher than the Little River well. Slick's well reports finding the Viola Sunday at 3812 feet. Opinion differs among the geologists as to the potentialities of this test, since some claim it is possible that the Slick well is very close to the Arbuckle uplift, while others state that the presence of the Viola indicates that the well will produce. This test will attract much attention for the next few days.

Mid-Continent Petroleum Corporation's test drilled in section 28-7-6, south of the Little River Pool, reports 3500 feet of water in the hole, having drilled to 4487-4495 feet. This test is one mile from the Barnsdall Oil Corporation's test in section 22-8-6, where the upper sand formations were found high, and this well is regarded as a prospective opener of a new productive area.

Magnolia Petroleum Company's wildcat, Markwell 1, in section 28-9-7, several miles east of the Seminole City pool, found the first and second Wilcox sands, but no show of oil. It is shut down at 4392 feet. Empire Gas and Fuel Company's Rogers 1, in section 20-8-6, southwest of Bowlegs, found a hole full of water in the Wilcox sand. These results assist materially in the determination of the

SEMINOLE DISTRICT PRODUCTION

24 hours ending 7 a. m. August 13

SEMINOLE FIELD

Company—	Production
Amerada Petroleum Corporation	2,880
Atlantic Oil Producing Company	750
Barnsdall Oil Corporation	5,885
Carter Oil Company	19,770
Empire Oil & Gas Company	2,019
Gypsy Oil Company	4,665
Independent Oil & Gas Company	975
Independent & R. F. Garlong	554
Independent & Inter-Ocean	524
Indian Territory Illuminating Oil Company	2,768
Kingwood Oil & Gas Company	1,203
Magnolia Petroleum Corporation	1,719
Mid-Continent Petroleum Corporation	880
McCullough & Phil-Mack	3,525
Phillips Petroleum Company	265
Prairie Oil & Gas Company	1,485
Pure Oil Company	5,605
Roxana Petroleum Corporation	444
Sinclair Oil & Gas Company	2,905
T. B. Slick, Inc.	5,638
Superior Oil Corporation	921
The Texas Company	290
Tidal Oil Company	3,777
Mid-Kansas Oil & Gas Company	259
Turman Oil Company	2,748
Total	72,524

SEARIGHT FIELD

Carter Oil Company	9,890
Gypsy Oil Company	907
Mid-Continent Petroleum Corporation	2,960
Prairie Oil & Gas Company	1,689
Pure Oil Company	5,642
Roxana Petroleum Corporation	2,692
Sinclair Oil & Gas Company	1,650
Twin States Oil Company	895
H. F. Wilcox Oil & Gas Company	2,160
Total	28,485

BOWLEGS FIELD

Amerada Petroleum Corporation	8,245
Atlantic Oil Producing Company	10,564
Barnsdall Oil Corporation	1,971
Carter Oil Company	21,190
Empire Oil & Gas Company	6,972
Gypsy Oil Company	4,185
Independent & Margay Oil	18,570
Indian Territory Illuminating Oil Company	52,885
McCullough, et al	617
Mid-Continent Petroleum Corporation	6,546
Minnehoma Oil & Gas Company	3,008
Prairie Oil & Gas Company	13,595
Pure Oil Company	16,317
Roxana Petroleum Corporation	3,200
Shaffer Oil & Refining Company	1,934
Sinclair Oil & Gas Company	21,160
The Texas Company	9,505
Tidal Oil Company	2,890
Twin State Oil Company	2,440
Total	187,944

EARLSBORO FIELD

Amerada Petroleum Corporation	16,045
Barnsdall Oil Corporation	24,553
Carter Oil Company	870
Continental Oil Company	6,695
J. E. Crosbie	10,677
Empire Oil & Gas Company	4,560
Gypsy Oil Company	5,064
Independent Oil & Gas Company	3,210
Independent & Darby	4,170
Independent & Margay Oil	18,570
Inter-Ocean Oil Company	440
Magnolia Petroleum Company	9,604
Mid-Continent Petroleum Corporation	11,370
Phillips Petroleum Company	3,229
Prairie Oil & Gas Company	18,420
Skelly Oil Company	9,903
The Texas Company	9,725
Tidal Oil Company	12,515
Twin State Oil Company	7,329
Roxana Petroleum Corporation	6,488
Total	183,437

LITTLE RIVER FIELD

Indian Territory Illuminating Company	Total 9,275

SUMMARY SEMINOLE AREA

Seminole Field	72,524
Searight Field	28,485
Bowlegs Field	187,944
Earlsboro Field	183,437
Little River Field	9,275
Greater Seminole total	481,665

western extremity of the Bowlegs field.

Important information regarding the Earlsboro field northwest extension developed yesterday when the Magnolia Petroleum Company reported a failure in the southeast of the northeast of the northwest of section 4-9-5. This test, Cowden 1, reports 3000 feet of water in the hole from the Wilcox found at 4467 to 4475 feet. The test is one-fourth mile north of the extension discovery well and location north of Independent and Margays large well on their O'Dell lease in the same section.

Water at Little River

When the Indian Territory Illuminating Oil Company's House 1, the only producing well in the Little River field, began showing water during the past week, the operators in the field deemed the development important enough that they should meet in the Cosden Building, Tulsa, and discuss future developments in the field. Although it was realized that the encroachment of water in the discovery well might foreshadow failures or short-lived producers for other wells now going down, there was no action taken, and drilling proceeds in the field. The well is reported to be cutting about three per cent water.

Operators point out that this water encroachment is a natural development in Wilcox sand fields, and of the 683 completions productive of oil in the entire Seminole area, 176 of them have been ruined by water. This is merely a repetition of the history of such fields as Cromwell, Garber, etc. Of the 176 wells which have gone to water in this great area over 100 are located in the older Seminole City pool and operators agree that this entire field will ultimately go to salt water.

Water is showing up in all of the productive areas of the Greater Seminole field. As a group the operators in the Little River field refuse to attach too much seriousness to the presence of water in the production of the discovery well, and operations in this section show no decrease during the past week as the result of this encroachment.

Little River has 15 new locations staked and 43 rigs up, with but one well inactive. Four wells are drilling at less than 2000 feet; 11 are drilling between 2000 and 3100 feet; two wells are drilling between 3100 and 3700 feet, and three are drilling below 3700 feet. There is a total of 78 operations in the field.

Activity Report, Other Sections

Earlsboro sector still leads in activity with 226 operations under way, which is a decrease of eight operations as compared with last week. Eight locations were staked last week, and 28 rigs are up. Eleven wells are inactive. There are a total of 190 drilling operations under way, of which number 64 are drilling below the 3700 foot level.

In the Bowlegs field there are 176 operations under way as compared with 200 a week ago. Ten new locations were staked; 21 rigs are up, and nine operations are inactive. Actual drilling wells number 145, of which there are 85 boring below 3700 feet.

Seminole City pool has 53 operations against 61 a week ago. One new location and one new rig is reported, with three inactive tests. Fifty-one wells are drilling, with 30 of this number below the 3700 foot level.

Searight has 29 operations, a decrease of one, as against last week's report. There is one new location, and three rigs up. Of the 25 tests actually drilling, nine of them are below 3700 feet.

A summary of the activity in the entire field, including Little River, shows a total of 562 operations. In the entire field there are 24 inactive operations, 98 rigs up and 35 new locations staked. There are 191 wells drilling below standardized depth, 3700 feet, which should add their output to flush production within the next two or three weeks. Seventy-four wells are drilling at less than 2000 feet. There are 96 wells drilling between 2000 and 3100 feet and 72 drilling operations working between 3100 and 3700 feet.

Operations in the entire area of Greater Seminole have decreased during the past week, and there are 37 fewer operations under way this week than the week before.

Pearson Switch Field

Drilling operations in the Pearson field has been of some interest during the past week. Magnolia Petroleum Company's Davis 1, in 30-7-4, is drilling at 4100 feet and filling with water. Pierce Petroleum Company's Ward 1, northeast corner of the southwest of section 30-7-4, which is making a test of the Wilcox horizon, found a soft streak in the lime formation from 4403 to 4410 feet, in which there was sulphur water, and is drilling ahead at 4440 feet.

In the Darby pool a new completion was reported when Magnolia Petroleum Company, drilling in its Lewis 1, in section 15-7-4, which is the farthest south well in the field, penetrating the Hunton lime at 3718 to 3723 feet, and made 265 barrels daily.

Logan County Operations

The Texas Pacific Coal & Oil Company contributed a new producer in the Logan County area during the past week. Its Speaks 1, in the southeast of the northwest of 33-18-4w, is reported producing 200 barrels into earthen storage. Four 500 barrel tanks are being rushed to completion, and gas trap is being installed. The oil is reported 42 gravity, with a yield of seven million cubic feet of gas from sand at 4133 to 4143 feet. The operators will clean out and deepen to aid the flow.

Wood, Gilbert & Wood, report their Gragg 1, in section 16-18-4w, holding up production of 17 million cubic feet of gas from a sand at 3994 feet. W. R. and W. E. Ramsey plan to spud this week in their test at Lovell 1, in the southwest of the northeast of section 16-18-4w. Blackwell Oil & Gas Company's Sade 1, northeast of the southwest of 28-18-4w, is drilling at 2600 feet. Texas Pacific Coal & Oil Company has material on the ground for its Quigley 1, in the northeast of the northwest of 28-18-4w, and has staked location for Barnett Roberts 1 in section 34.

Roxana Petroleum Company's McCulley 1, near Lovel, in the northwestern part of the county, is still a consistent producer. This test started out making 2400 barrels daily from 5987 feet. It is in section 30-19-4w. Roxana has location staked in 17-19-4w, it is rigging up for Ross 1, in section 29, has spudded in Sebronek 1, in section 30, is drilling Stephens 1, in section 29, and is drilling in Williams 1, in section 32-19-4w.

On the Lovell townsite, Pawnee Petroleum Company et al are preparing to resume drilling on No. 1 in section 19-18-4w, after being shut down for some time at 4500 feet. Bryan & Emery et al's Scott 1, in the northwest of the southwest of 33-19-4w, is drilling at 4700 feet. This well has reported some showings of oil and gas. J. P. Haley, Sunray Oil Company et al's Quier 1, in 33-18-4w, is drilling with rotary at 4100 feet. Carter Oil Company's Rogers 1, in section 32-19-3w, reported a show of oil below 5600 feet.

Development at Dale is Being Rushed

Houston—That the new pool opened two weeks ago by The Texas Company's Beaty 1 wildcat, four miles southeast of Lytton Springs, Caldwell County, will be developed rapidly is indicated by seven locations made early this week by The Texas Company. These locations are yet tentative, pending approval of the New York office of the company, and if approved, will bring the total number of locations of The Texas Company surrounding the discovery producer to eight.

Aside from work under way by the discovery company, Wheelock & Collins, drilling contractors, have four locations ready to rig up. Reports were rumored early in the week that the Sun company was planning immediate activity in the Dale section, but no official announcement was made to that effect. The Humble, a large acreage holder near the discovery well, had announced no locations up to August 16.

Beaty 1 was flowing by heads at a rate of 100 barrels of 39 gravity pipe line oil Monday, after swabbing 250 barrels daily for more than a week.

Magnolia Petroleum Company has

completed a two-inch four-mile line from the Lytton Springs field to the Dale well to take care of the present production. Two 1000-barrel steel storage tanks erected by The Texas Company prior to completion of the well took the oil until Magnolia's line was laid.

Work at Boggy Creek Continues Active

Houston—Humble Oil & Refining Company made location late last week for a wildcat to be drilled on the J. H. Russell tract on the southwest side of Boggy Creek dome, which, when spudded will make six active operations of the Humble in the Boggy Creek vicinity.

Russell 1 is located 1300 feet east and 1900 feet south of the northwest corner of the J. H. Russell tract in the Nancy Cannon survey, Anderson County.

A derrick is building for Elliott-Clark 2, a location which was made shortly following completion of the discovery well, but which was temporarily abandoned after the well failed to hold up to its initial yield.

Production from Elliott-Clark 1, discovery well at Boggy Creek, was 590 barrels, 512 barrels of which was salt water. The well has been on the pump for the past three months.

Humble's Southern Pine A-2, near Jarvis, Anderson County, was drilling August 15 at 5005 feet in sand rock. Southern Pine B-1, near Camp Hill, Anderson County, about seven miles east of Palestine, was drilling at the same time at 4780 feet in shale and lime. Earle & Ragsdale 2, the first well spudded by the Humble following completion of the discovery well, was 4506 feet, and the Reynolds Mortgage Company 1 was 2929 feet in shale and boulders.

Plan Additional Drilling On Garland Anticline

Casper, Wyo.—Ohio Oil Company has completed a 40,000,000 cubic foot gasser on the Cross Gas Company lease in Big Horn County, Wyoming, section 33-56-99. Total depth is 3163 feet. Structure is known as Garland anticline, and lies between the Byron field and the McMahon structure, all southeast of the Elk Basin district. It has previously been wildcat territory and the shallow depth at which production was found has shown it to be different from its sister structures, McMahon and Byron. The completion is considered very important. Producers & Refiners Corporation, it is said, plan to drill another test on its holdings (held jointly with Kinney-Coastal interests) on the structure. Location for the test has not been announced, but it is known that it will be probably farther down on the structure than one which is now plugging back to save as a gas well in the shallower sands.

8000 Barrel Producer Starts Drilling Rush on Northwest Side Yates Shallow Field

By H. H. KING
Staff Representative

SAN ANGELO.—Two new producers were in process of completion early this week on the Pecos River side of the Yates shallow field, and an active drilling program has been launched on the northwest side of the field since the completion last week of McMan and Marland Oil Company's Yates 1, making 350 barrels hourly. The field has 13 completed wells estimated good for 60,000 barrels or more daily, but current production is being held to less than 6000 barrels.

Mid-Kansas and Transcontinental Oil Company's Yates 3-B, an offset to the river bed producer, encountered the lime pay at 888 feet Thursday, being shallower than any other well in the field and gauged about 18 barrels per hour for the first 13 hours. This well was deepened to 912 feet early Tuesday and is reported to have increased its flow to 85 barrels hourly.

Marland Oil Company's Yates 1, lease A, a south offset to the above new well, hit the oil pay Monday at 963 feet and began filling with oil after drilling 12 feet in.

Humble, Simms Oil Company and the California Company have begun moving in materials to drill on their M. A. Smith leases since the spectacular performances of the McMan-Marland well on the Yates ranch. Three offsets will be drilled against the latter producer, while the position of the new locations made by Simms and Humble will require three offsets around each if commercial wells are scored.

The Marland-McMan well found the big pay at 1312 and drilled in two feet. This well was pinched to 410 barrels daily early this week with 300 pounds back pressure.

The next important completion in the Yates area is the Mazda-Redbank Oil Company et al's Smith 1, located in section 24, and about two and one-half miles southwest of production. This test is shut down for casing and packer with some oil in the hole from pay at 1468 to 1472 feet. It logged the salt at 850 feet, with a surface elevation of 2706 feet. Allsman and Bell's second test in the Pecos River bed appears to be a bloomer, as it failed to encounter the big lime after drilling to 1510 feet, with a surface elevation of 2155 feet, and has been shut down. It is two miles up the river from the producer.

The Texas Company's Perry 2, located on the north line of section 3, widened the McCamey field one location further southeast with a natural flow of 140 barrels of oil during the first hour from lime pay at 1953 to 61 feet. The well began cutting oil from the start, and the production had to be pinched more than half, owing to limited facilities for treating the fluid. This company's Perry 3 is expected to be equally as large a producer, as it is showing gas in the upper horizons and checking high, but it will not be drilled until the big well is amply cared for. This development indicates that the southeast end of the McCamey field is still wide open.

New locations are being made in large numbers for the Hendricks field, Winkler County, and rotary rigs are to be very much in demand for carrying these tests down to the big lime then drill in with cable tools.

The Texon Oil & Land Company's test on the east side of the Hendricks field and one-half mile in advance of production remained unchanged over the week, except that the gas flow was increased from five to about 25 million feet at 2795 feet. This well is reported to be running five-inch casing at 2814 feet. It has been drilled 494 feet in the big lime and should have encountered oil when about 300 feet in the lime. Southern and Westbrook & Company's Hendricks 1, lease A, section 44, increased its flow to about 800 barrels daily when deepened to 3030 feet, or nearly 100 feet in the pay.

World Oil Company's wildcat test on the Duff ranch in Reeves County is fishing two strings of tools with oil and water in the hole after scratching the top of oil pay at 3655 feet. This test was drilled to 1400 feet in 1923 and abandoned, but was taken over by World last spring and contracted to go to 5000 feet.

The flush life of the wells in the Church & Fields area, Crane County, is exceeding early estimates, and the producers hit by the proration rule put into effect July 19 are having to erect more tankage to avoid shutting down of wells. Landreth Production Corporation's State-Strip 11, located on a long narrow strip separating the Church & Fields and Gulf-McElroy areas, came in early last week flowing natural 4,300 barrels during the first 20 hours from 15 feet of saturated lime pay drilled to a total depth of 2840 feet. This well crowded the flow lines from the start, and steadily increased its flow as larger connections were put in place until the output climbed to 9,000 barrels daily. This big well was holding at 8,100 barrels daily Sunday, and Landreth's total production from 12 wells amounted to 13,795 barrels.

Simms & Atlantic Oil Producing Company are leading the list of producers in the Church & Fields area with a production of more than 22,000 barrels, of which all but 10,000 barrels is being stored in the field.

Texas Panhandle Stocks Gain Only Slightly During July; Deep Drilling Disappointing

AMARILLO, Texas.—Skelly Oil Company's wildcat test on the Armstrong & Byrd land on the east edge of Moore County was flowing 150 barrels 33 degree gravity oil daily early this week after being drilled 33 feet in the lime pay to a total depth of 3212 feet. This well is located about two miles east of M. Cadman et al's Sneed 1, which uncovered the first oil production in the county late in December with a small output, and is in the southwest corner of the Freeman Bazemore survey. The Skelly wildcat logged the top of the big lime at 2210 feet, with a surface elevation of 3311 feet, and cased off heavy gas flow at 2775 feet. Storage is being erected to drill deeper on the Skelly well. This completion affords the third oil producer for Moore County, as A. D. Morton et al of Bartlesville recently completed a flowing well in the north central part of the county.

The outer rim of the Cockrell Ranch section of Hutchinson County added another good producer early this week when the Roxana Petroleum Corporation's Cockrell 1, located in the southwest corner of the north half of the southeast quarter of section 3, block B-3, blew in making about 500 barrels oil with heavy gas flow from the regular pay. This well is a diagonal offset to a small producer. The Texas Company's Cockrell 2 widened the field to the east with a flush flow of 700 barrels natural from lime pay at 2821-86 feet. These two completions revive the possibilities of the flush area being expanded.

Efforts for deeper producing horizons underlying the main part of the Hutchinson County oil area were given a setback during the past week when the Phillips Petroleum Company's Whittenburg-Elra 12 developed a hole full of salt water at 4202 feet, with 5 3/16-inch casing set at 4143 feet. The Red Hill Petroleum Corporation's Johnson-Deal 1, located in section 88 and on the south side of the river in Hutchinson County, is to be completed as a gasser estimated at 40 million cubic feet in upper lime horizon at 2600-35 feet. The John Knorpp Interests, who are shaping plans to build a 24-inch gas line from the Texas Panhandle district to Kansas City, are making contract to purchase this gas production. The Knorpp Interests have been soliciting gas contracts on basis of two cents per 1000 cubic feet at the well.

The Bowers section of the Wilcox-Pampa field, Gray County, added its second producer with the partial completion of the Majestic Oil Company's J. B. Bowers 6, making about 300 barrels natural from granite wash pay at 2885-2963 feet, with a surface elevation of 2989 feet. This well is located near the discovery well, and in the southeast part of the northeast quarter of section 93, block B-2, H&GN survey.

Crude stocks in the Texas Panhandle district registered only a small gain during July, having accumulated at the rate of 5,720 barrels daily. Total crude stocks on hand at the close of July were reported as amounting to 18,796,920 barrels, or an increase of 177,290 barrels. The operation of the Magnolia-Gulf, Humble and Prairie trunk lines near capacity throughout the month afforded the principal outlet, while local refinery consumption and tank car shipments materially aided in holding down the storage.

Crude stocks in the Texas Panhandle district at the close of July is listed below by companies:

Company—	Barrels
Magnolia Pipe Line Co.	3,782,140
Phillips Petroleum Co.	3,254,000
Gulf Pipe Line Co.	3,250,000
Prairie Pipe Line Co.	2,366,460
Marland Pipe Line Co.	2,033,770
Skelly Oil Company	1,057,700
Plains Pipe Line Co.	639,500
Humble Pipe Line Co.	623,500
Roxana Pet. Corp.	320,000
Cockrell-McIlroy Interests	245,055
Empire Gas & Fuel Co.	198,300
Bell Oil & Gas Company	186,000
Japhet Production Co.	103,385
Devonian Oil Co.	99,940
Dixon Creek Oil Co.	99,850
J. J. Perkins et al	79,235
Mid-West Exploration Co.	65,570
Derby Oil Company	61,345
American Refining Co.	52,550
Sunny Jim Oil Co.	52,485
Champlin Refining Co.	51,170
Coble-Whittenburg Oil Co.	49,985
Atlantic Oil Prod. Co.	48,170
Pantex Oil Company	32,920
The Texas Company	28,450
Julian Petroleum Corp.	15,440
Totals	18,796,920
Totals close June	18,619,630
Increase	177,290

Salt Water in Trinity Sand Wells Discounts Value Of Recent Discovery at Pine Island

Shreveport, La.—The only interesting news during the unusually quiet week just passed, was the completion of a producing Trinity sand well in section 23-17-12, Bossier Parish, seven miles north of the present nearest producing territory, the Elm Grove gas field.

This well, Sligo Syndicate's Jeter 1, was reported showing for a three to five barrel producer in last week's issue, from a depth of 4272 feet. After liner had been set at this depth and the sand and shale which had heaved in had been cleaned out, it was reported that the well was flowing at the rate of 40 to 50 barrels of 41.6 gravity oil each 24 hours. Considerable difficulty is being encountered from sand trouble and it is not expected that the well will increase its production until this trouble has been overcome.

Nothing of interest was reported from the Trinity sand drilling in the Pine Island district during the week, all wells now drilling not yet having reached an interesting stage. The rapid rate at which the production from the present producing wells is declining, together with the encroachment of salt water upon the oil sands, may result in a temporary halt in the drilling campaign now being conducted as the result of the completion of several large wells in this formation during recent months. A study of the field's production report reveals that the majority of wells now producing are making a large quantity of salt water, usually in excess of the oil production, and that the water percentage is increasing, while the oil output is rapidly decreasing. Notable among these is the Haynes Brother's record Murray well which, completed July 3 as a 16,000 barrel well, and it was restricted to a flow of approximately 7000 barrels, is now flowing at the rate of 900 barrels of oil and 5000 barrels of salt water per day. Although this well is offered as an example, it is about on par with the other deep producing wells in the territory in point of production decline. The largest single producer in the field now is The Texas Company's Herndon 5 well, in section 14-21-15, completed August 5 as a 4000 barrel well, which is now making 2900 barrels of oil and 3500 barrels of salt water.

Despite the fact that production is rapidly falling off, the ardor of the present operators in the field refuses to be dampened, so far. There were four permits issued for new wells in the district last week, two of which were secured by the Standard Oil Company for Stiles wells Nos. 188 and 189, located in sections 33 and 27-21-16, respectively; and two were issued to The Texas Company covering Caddo Mineral Lands 50, in section 23-21-15, and Herndon 9, in section 14-21-15. The latter location is in the same section as the Herndon 5, recently completed as a 4000 barrel gusher. In addition to these new tests, there are about 25 rigs now running in the general vicinity of the section in which the first Trinity sand producer was completed.

The Humble Oil and Refining Company made a Johnson sand test in a hard sand formation encountered in the Bliss and Weatherbee 30 deep test, in section 15-19-11, Bossier Parish, last week, following a slight showing of oil on the ditch at this depth. The test, however, failed to reveal anything of interest.

Then The Driller Interrupted-

AN oil field representative of the Crucible Steel Company of America was talking with the Purchasing Agent of an oil company when the Superintendent of Drilling Operations entered.

The Driller, who did not know the representative of the Crucible Steel Company of America, took no part in the conversation until well bit steel was mentioned.

Then the Driller interrupted. "I have tried everything in the country and the last and only thing in bit steel is Crescent Hammered Steel and I intend to use no other."

Taking a book from his pocket, he continued, "We have made 1,102 fish tail bits of Crescent Steel. Four of the total were claimed to be defective. One I know was spoiled in the making. The other three I did not see."

Of course, introductions were in order. Then the Driller made another interesting comment, "Your Crescent Steel is not only good, but the price is right."

If you, too, want bits and jars that make more hole, keep their gauge longer and require fewer dressings, specify Crescent Hammered Bit and Jar Steels.

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PERSONAL MENTION-MEN YOU KNOW

H. N. Blakeslee, field representative, petroleum section, National Safety Council, Chicago, was in Houston early this week on a tour of fields in the Southern territory.

J. C. Case, assistant manager of the crude ail department of the Vacuum Oil Company, is making an automobile trip through West Texas this week.

Carl Russ, chief clerk of the Gulf Production Company at Houston, has gone to Orange, accompanied by his wife and their two children, and will spend a part of his vacation there visiting relatives.

Rufus J. Pilcher, statistician for the Richfield Oil Company at Los Angeles, has returned from San Francisco, where he spent a few days seeing the Hawaiian fliers off in the Dole race. Rufus is an aviator himself, and a good one, too.

T. S. Cooke, who has been Rocky Mountain manager for the Standard Oil Company of Indiana, with Casper headquarters, has been put in charge of the Pan-American Petroleum & Transport Company's business in Venezuela and will henceforth have headquarters probably in New York City. The Pan-American is to construct a 60,000 barrel refinery in Venezuela, and for this purpose has either "borrowed" some of the best experts in the Standard's personnel in Casper, or has transferred them to South America permanently. M. G. Paulus who has been superintendent in Casper of No. 3 Plant for the Standard, will take Mr. Cooke's position.

Dr. Donald C. Barton, consulting geophysist, Houston, made a short vacation trip through Central-West Texas last week.

Fred P. Shayes, geologist for the Houston Oil Company, Houston, left late last week for a trip through Southwest Texas, inspecting company properties.

W. C. Bob, superintendent of the Cole Petroleum Company, Laredo, Texas, is on a vacation of a month in California, accompanied by his wife.

H. J. Barnes, former Shreveport manager for Peden Iron & Steel Company, has been transferred to Beaumont where he succeeds W. W. Plowden, resigned.

W. N. Finnegan, chief statistician for Humble Oil & Refining Company, Houston, is taking a two week's vacation motoring through the mountain country of southwest Texas.

Dan J. Moran, vice-president in charge of production for The Texas Company, and Bert E. Hull, president of The Texas Pipe Line Company, departed from their New York headquarters early last week via airplane for a tour of the company's properties in the Southwest. The two officials made their first stop at Tulsa, thence to Amarillo and Artesia, New Mexico, with brief stops at McCamey, San Angelo, Austin and to Houston.

C. C. Cartwright, vice-president of the National Supply Company with headquarters at Fort Worth, is spending his vacation at a popular summer resort near Colorado Springs, Colorado.

O. W. Biggs, field superintendent for The Texas Company in the Humble district, returned last week from a vacation spent in New Mexico and West Texas.

William Nicholas, driller for the Dixon Creek Oil Company in the Borger field, was killed August 14, when he slipped in wet clay and fell in the bull wheel.

E. R. (BOB) AMES

Who recently became Mid-Continent manager for the Elliott Core Drilling Company with headquarters at Houston. Mr. Ames was formerly with the Elliott organization in Los Angeles and more recently has been connected with the Empire Companies on the West Coast. He is a graduate of Stanford University and served as secretary of the California section of the American Association of Petroleum Geologists at one time. Mr. Ames is now spending his time getting acquainted with the trade in the Gulf Coast area.

Harry Minard, formerly with National Supply Company, is now with Wilson-Snyder Manufacturing Company, as slush pump specialist, headquarters at present in the Seminole field. Mr. Minard recently spent several weeks at the Wilson-Snyder factory making a study of this company's slush pump. His permanent headquarters in Oklahoma will be at the office of the Murray Tool & Supply Company, Tulsa.

Judson C. Welliver resigned his position as director of public relations of the American Petroleum Institute to become editor of the Pittsburg Post-Gazette, assuming his new duties August 2. In a recent announcement the Institute expressed its regrets at losing the services of Mr. Welliver and extended to him its best wishes in his new position.

H. A. Melat, superintendent of production for the Gulf Production Company in North and West Texas with headquarters at Fort Worth, has returned from a month's vacation spent at Manitou, Colorado.

Chicagoans Drop Plans For Carbon Black Plant

Casper, Wyo.—Chicago parties who took options on Pine Mountain gas for the construction of a carbon black plant near this city have failed to exercise these options and although an agreement may still be reached, it is considered doubtful. Local interests are reported to have met all requirements of the contract. As originally planned, gas from wells already completed on Pine Mountain, was to have been utilized in the carbon black plant which was to have been built at Natrona station. B. B. Baker of 19 South LaSalle Street, Chicago, represented the Chicago interests.

Gas Found at Shallow Depth on Colorado-Wyoming Line

Denver, Colo.—A flow of gas sufficient in quantity to make a flame 18 inches high has been encountered at 176 feet on the Clark ranch, one mile east of Dixon, on the Snake River, on the Wyoming side of the Colorado-Wyoming line. Well was drilled by T. D. Ervin to obtain water for stock and ranch purposes. Water flow is about 10 gallons per minute. The well is not far from Snake River test of the Ohio Oil Company, which was abandoned at 3015 feet two years ago. Location was on section 13-12n-89.

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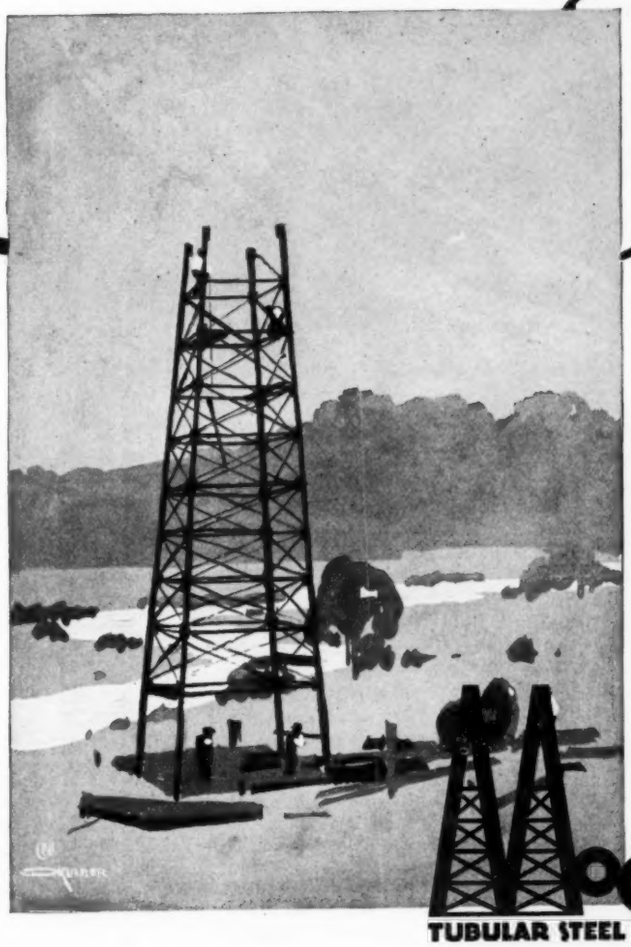

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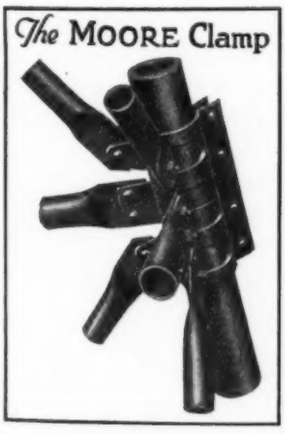

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Texas Buys Half Interest in Cosden Wildcat

Fort Worth, Texas.—The Texas Company has purchased a one-half interest in J. S. Cosden et al's wildcat oil producing property on the W. E. Connell ranch, Ector County section of West Texas, paying $150,000 cash and agreeing to drill two tests free. Texas assumed operating control, and will start two tests shortly. This deal involves approximately 10,250 acres of leases, which are mostly confined to Public School Lands survey, block B-16, and the discovery well which is making about 25 barrels of 36 gravity oil daily from lime at 3465-82 feet, with a total depth of 4002 feet. Cosden et al recently drilled two tests down to the pay horizon near the discovery well, but porduction gauges have not been made, although both showed for small pumpers. The gravity of the oil produced in this area is much higher than that found in nearby counties.

West Texas Production

CRANE COUNTY

	Producing Wells	Daily Average Prod.
Church & Fields—		
Simms Oil Co. & Atlantic	20	22,380
Eastland Oil Co. & Collett-O'Keefe	6	10,305
Humble Oil & Refining Co.	11	7,500
Tidal Oil Co. & Turman-Maxwell	14	6,600
Landreth Production Corp.	10	5,855
Pecos Oil Company (Cromwell et al)	8	4,530
Magnolia Petroleum Co.	21	2,480
Geo. Church-Fields & Bert Weekly	3	2,425
Gulf Production Company	10	2,310
Prairie Oil & Gas Co.	2	1,870
Independent Oil & Gas Co.	3	1,470
Geo. Church & Bob Fields	2	295
The Texas Company	1	180
Stidham & Thrasher	1	10
Totals	112	68,210
Gulf-McElroy—		
Gulf Production Company	33	18,225
Gulf-Waddell—		
Gulf Production Company	1	25
Marland-Hughes—		
Marland Oil Company	16	950
The Texas Company	10	285
McMan Oil & Gas Company	2	75
Independent Oil & Gas Company	1	10
Totals	29	1,320
Totals For Crane County	175	87,780

UPTON COUNTY

Gulf Production Company	13	3,125
Dixie Oil Company	34	3,115
Roxana Petroleum Corp.	37	2,905
Texas Pacific Coal & Oil Co.	14	2,725
Marland Oil Company	78	2,665
Independent Oil & Gas Co.	26	1,185
Prairie Oil & Gas Co.	6	1,080
Humble Oil & Refining Co.	8	885
The Texas Company	17	530
Amerada Petroleum Corp.	6	370
Sun Oil Company	10	240
Snowden & McSweeney	1	175
Republic Prod. Co. & Marland Oil Co.	5	125
Wentz Oil Corporation	3	125
Tidal Oil Company	2	100
Simms Oil Company	3	95
Bryant & Atlantic Oil Prod. Co.	2	65
Pure Oil Company	1	40
McMan Oil & Gas Company	2	40
Atlantic Oil Producing Co.	1	30
Texon Oil & Land Co.	1	20
White Eagle Oil & Refining Co.	1	10
Totals	271	19,650

PECOS COUNTY

Mid-Kansas-Transcontinental	10	*4,480
The California Co.	1	*450
McMan-Marland Oil Company	1	*350
Allsman-Bell et al	1	150
Totals	13	5,430

REAGAN COUNTY

Big Lake Oil Company	116	20,040
Texon Oil & Land Company	79	6,260
Totals	195	26,300

WINKLER COUNTY

Southern Crude Oil Co.	4	*1,290
Pure Oil Company	1	*575
Gulf Production Co.	1	*430
Independent Oil & Gas Co.	1	45
Totals	7	2,340

JONES COUNTY

Phillips Petroleum Co.	10	990
Marland Oil Company	3	385
Mid-West Exploration Co.	4	225
Stebbins Oil & Gasoline Co.	1	20
Atlantic Oil Prod. Co. et al	1	5
Totals	19	1,625

MITCHELL COUNTY

The California Company	91	2,730
Magnolia Petroleum Co.	22	615
Eastland Oil Company et al	9	180
Atlantic Oil Prod. Co.	8	130
Tidal Oil Company	2	30
Fred Carey et al	1	15
Totals	133	3,700

HOWARD COUNTY

Marland Oil Company	32	1,330
Magnolia Petroleum Co.	30	960
Pure Oil Company	4	260
Lockhart & Co. et al	7	170
Frank M. Greene & Co.	2	150
Bristow & Merrick	3	115
F-H-E Oil Company	1	55
Tidal Oil Company	2	40
Humble Oil & Refining Co.	2	35
Mid-West Exploration Co.	2	35
Owen-Sloan et al	1	30
Comet Petroleum Co.	2	25
Godley Oil & Gas Co.	1	25
Gulf Production Co.	2	20
Dixie Oil Company	1	10
Totals	92	3,260

CROCKETT COUNTY

P. H. Williams et al	1	525
Humble & Marland Oil Co.	11	365
J. K. Hughes Dev. Co.	4	205
Republic Production Co.	2	175
Carl Cromwell	3	135
Gulf Production Co.	6	115
Roxana Petroleum Corp.	1	15
Humble Oil & Refining Co.	1	5
Totals	29	1,540

SCURRY COUNTY

The Northwest Co.	5	45

GLASSCOCK COUNTY

Marland & Texon Oil & Land Co.	1	35

LOVING COUNTY

Lockhart & Company	2	30

GARZA COUNTY

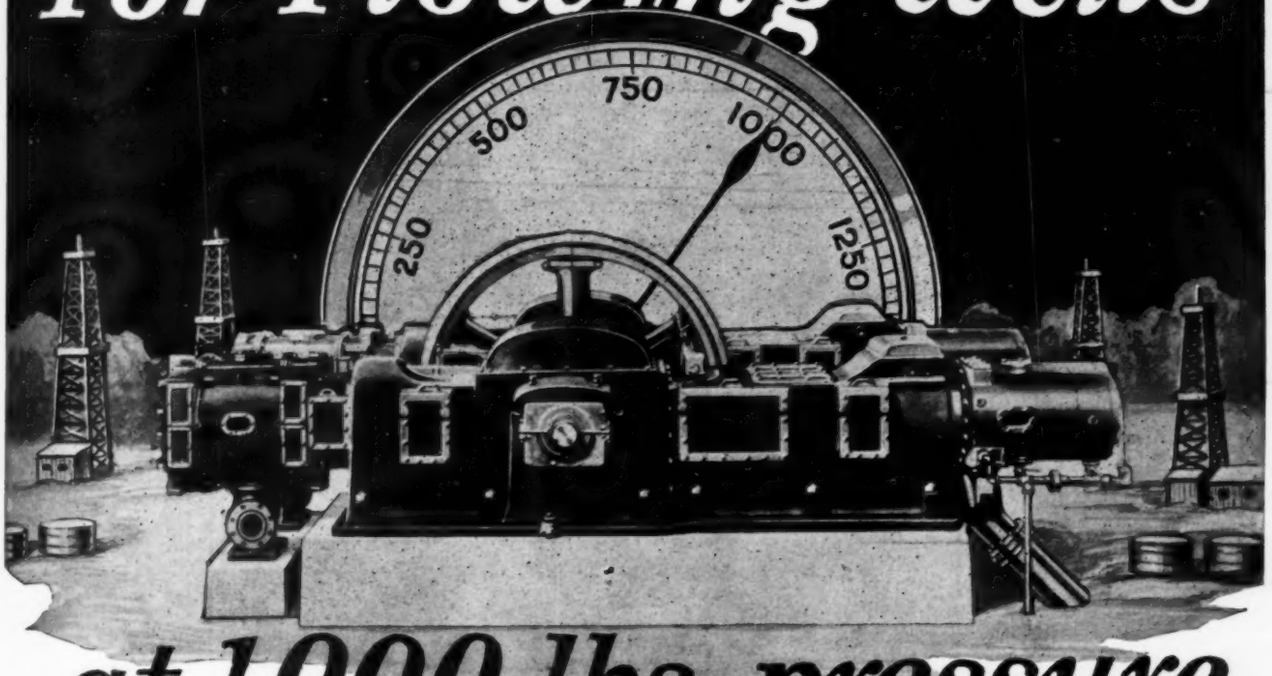
Emerald Oil Company	1	7

ECTOR COUNTY

J. S. Cosden & The Texas Co.	1	..
Totals all fields past week	943	151,742
Totals previous week	921	141,525

*Production partially pinched.

For Flowing Wells



at 1,000 lbs. pressure

YOU need Bessemer's proven reliability and high safety factor for this high-pressure work. You need the time tried, field tested performability that only a high pressure Bessemer can give you at the high pressures necessary for this flowing work.

Bessemer developed and perfected the high pressure type ten compressor for flowing wells. Now they are at work by the dozens in the Seminole, Okla., El Dorado, Ark. and other fields. They have been proved on the job—dependable, highly efficient and economical.

The high pressure Bessemer Type Ten Compressor is built especially for flowing well with compressed gas or air at high pressures. Special air cylinders are mounted on and direct connected to, a 165 H.P. twin Type Ten bed plate, and the entire unit is constructed with a wide margin of excess strength to insure a big factor of safety at the maximum pressure capacity.

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Quick delivery can now be assured because of increased production.

Designed and built *specifically* for high pressure work of flowing wells.

Easily handles the high pressure necessary to start flow of well.

One high pressure Bessemer can be used either on an individual well or in a central plant to handle a number of wells, depending on conditions.

Sturdy, economical, highly efficient, and dependable—all proved by performance in the field on high pressure work.

BESSEMER

Say you saw it in The OIL WEEKLY

Lift Efficiency Depends Upon Skill in Design and Operation

(Continued from page 46)

may be pumped for the time without reference to water encroachment from below, while the lower sand will require more careful operation as to back pressure. However, with or without water, there is no material difference in the result sought; in either case, the main consideration is that of holding formation gas in the formation as long as possible, for formation gas is the sole propelling agent in flush production for driving oil through the sand to the well bore; that is, the pressure of gas maintained on the sand is the most potent factor of flush production.

When rock pressure subsides to approximately the level of the sand, extensive revision of piping will be necessary, or, I should say, that at any stage of production, back pressure control is the most important factor, becoming more important as the rock pressure lowers.

And here the writer might say again that air and gas lift has its greatest and most permanent field in handling settled production. When cleaning wells, when pulling and replacing rods and tubing, there is risk; when rods or tubing part, there is risk, together with expense. The elimination of all working parts in a well means the elimination of much expense; air lift eliminates these well working parts and since the Mid-Continent is no longer gun-shy of air, the writer believes that its use will be continued in settled fields.

Submergence

Submergence of air or gas line is not truly indicated by the gauge pressure reading at the surface for there is friction of air in the piping between gauge and bottom of air line, but the working submergence may be obtained by quickly closing the air line valve, when the pressure, as shown on gauge, subsides for a few seconds, and then rises again. The lowest pressure reading so obtained is the submergence pressure in pounds, and for determining the height of oil that corresponds to pounds pressure, the following table is appended, taken from the writer's note book:

Table No. 1

Gravity of oil Beaume	Specific Gravity	Weight per gallon in lbs.	Pressure caused by submerging a pipe 100 feet, pounds	Actual Horsepower required on lift one barrel 100 ft
15	.9660	8.048	41.82	1.023
16	.9595	7.994	41.54	1.015
17	.9530	7.939	41.20	1.009
18	.946	7.885	40.96	1.002
19	.94	7.831	40.70	0.995
20	.934	7.781	40.44	0.989
21	.928	7.731	40.18	0.983
22	.922	7.681	39.92	0.976
23	.916	7.635	39.66	0.97
24	.91	7.581	39.40	0.964
25	.904	7.536	39.14	0.957
26	.899	7.49	38.92	0.952
27	.893	7.44	38.66	0.946
28	.887	7.39	38.40	0.939
29	.881	7.344	38.14	0.933
30	.875	7.294	37.88	0.927
31	.871	7.248	37.70	0.922
32	.865	7.206	37.46	0.916
33	.856	7.16	37.17	0.906
34	.855	7.20	37.03	0.905
35	.849	7.073	36.87	0.899
36	.844	7.031	36.54	0.893
37	.839	6.994	36.32	0.888
38	.834	6.952	36.11	0.883
39	.829	6.911	35.89	0.877
40	.825	6.873	35.62	0.873
41	.821	6.836	35.54	0.869
42	.815	6.794	35.28	0.863

In using this table, the actual Beaume reading is used, without temperature correction.

Maximum submergence percentage is of course, when the well is first placed on air, and, as rock pressure lowers, and the air line is lowered, submergence the percentage obtainable gradually decreases, setting up lower operating efficiencies successively, until bottom is reached. But, with the air line on bottom, an efficient installation for quantities of oil as low as five barrels per day is possible, considering the problem as a whole.

All wells pumped with air or gas, operate with submergence, for the very principle upon which the air lift is based is submergence. It may seem that there is no submergence, from a well pumped as in Figure No. 1, but submergence is here indicated by pressure at the lower end of inner pipe. Without submergence, no air lift can operate.

Following a well through all its stages of production, from the initial flowing period, through to the period when formation pressure is exhausted. If the well is active, air or gas line cannot be installed, of course, but, immediately the well will permit, air lift

FIGURE 9
Distribution lines on installation in the Bowlegs area

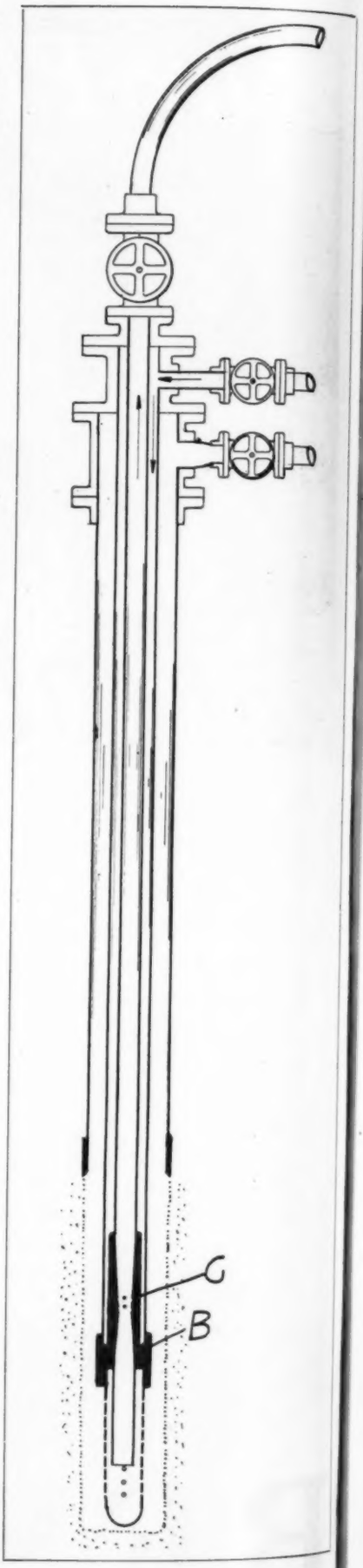
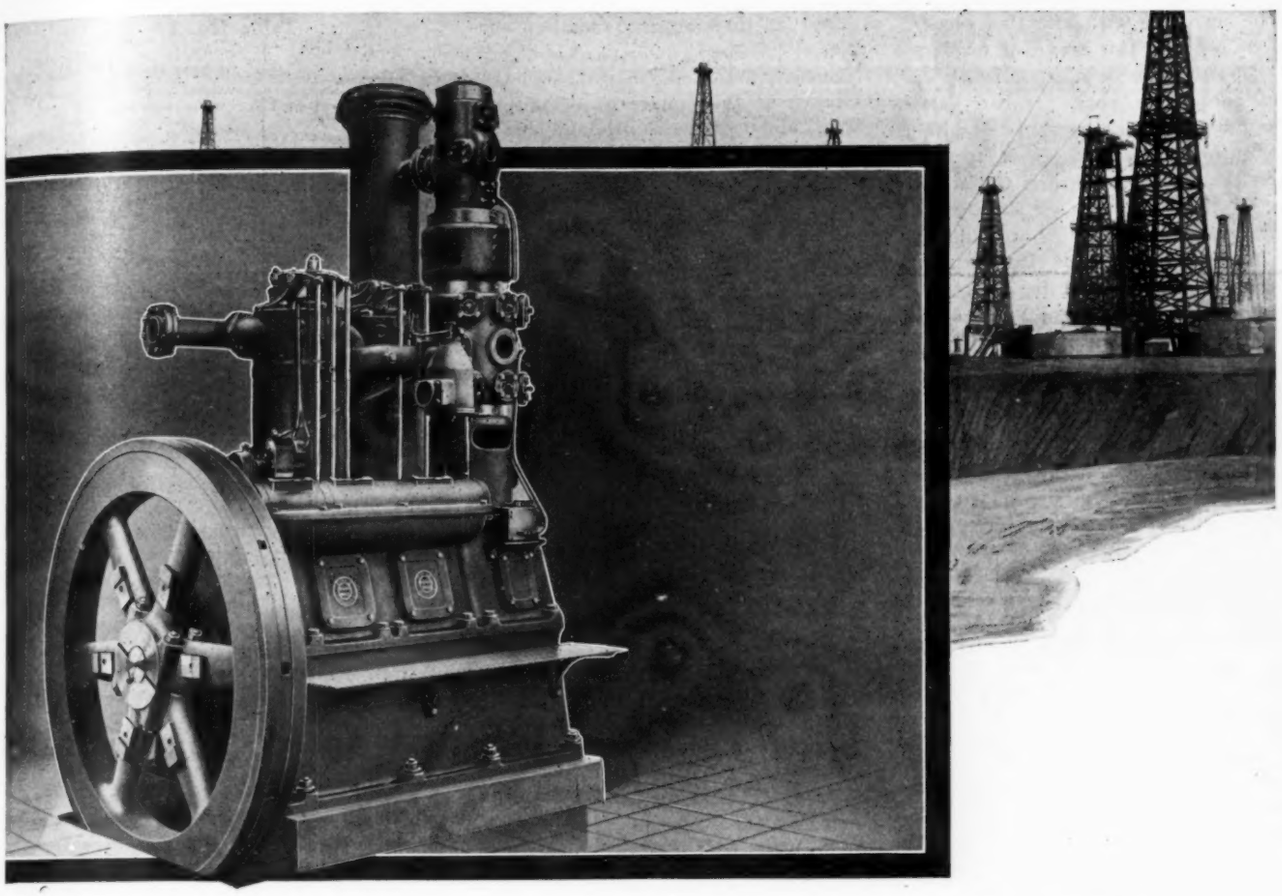


FIGURE 8
Pennington Air Lift Pump with Regan well head equipment



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Purchasers of CP Compressors and Engines obtain well seasoned products, modern in every respect, and receive complete technical service in their selection and installation. The wide range of CP units enables you to center your entire compressor requirements in one manufacturer if you should so desire.

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- Compressors for flowing of wells.
- Vacuum Pumps, Condensers and Compressors for Refinery Service.
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- Gas Engines, 90 to 540 h. p.
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may be installed with effective recoveries of oil. At this stage of production, back pressure is of material benefit in conserving rock pressure, and holding back such pressure on the same, rather than releasing it, for the reason that rock pressure is the active agent in the formation for driving oil toward and into the well bore, and by utilizing this pressure for that purpose, so far as possible, and lifting oil to the surface by means of compressed gas or air pumped down into the well, the highest total recovery can be made that is possible from the natural pressure found on the sand initially.

But when rock pressure has subsided to such point that operating pressure of pumped in gas or air is equal to or exceeds the formation pressure, then the well may not produce as much as when operating pressure from compressors is held down to a lower point than the rock pressure then existing. At this stage means must be taken to pump the well without placing back pressure on the sand if the same pumping equipment—air or gas—is to be continued, and there is no reason why the same pumping equipment cannot be used throughout the life of a well, provided of course, that vacuum is not placed on the well.

Slippage

An air bubble rises in liquid due to pressure or weight of surrounding liquid on the lighter air or buoyancy, and, due to the lesser specific gravity of air, the bubble rises. Traveling upward, surface of bubble in contact with liquid sets up friction between air and liquid. Friction being proportional to surfaces in contact, it follows that a unit volume of air in a single bubble sets up a definite friction quantity at definite speed. Hence, to divide the same air bubble into many bubbles means that greater surfaces are exposed for developing frictional contact areas. Take a bubble containing one cubic inch of oir, at the pressure obtaining, whatever it is. The diameter of this bubble is one and one-fourth-inch and the exposed surface of a truly spherical bubble of this size is 4.90 square inches.

Now, the same bubble may be divided into smaller sizes, and say we have divided it into bubbles one-eighth of an inch in diameter, each containing 00102 cubic inch of air. There will then by 1000 bubbles each one-eighth-inch in diameter. The surface of these 1000 bubbles is 49 square inches, or just ten times as much when finely divided, and the same amount of air then does far more work, for frictional work is proportional to the frictional contact areas.

Thus, foot pieces that secure finely divided air bubbles, without question can and do make an air lift more efficient than where say a two-inch diameter opening admits air without an attempt at division into smaller surfaces.

Velocity affects slippage, for friction increases as the square of velocity in nearly all instances, although in air transmission the ratio is slightly more than the square of velocity. For instance, air traveling at four feet per second develops slightly more than four times the friction of the same air traveling in the same space at two feet per second.

It has been shown also that large air bubbles travel upward in liquid faster than small bubbles.

Hence, by these rules already established by experiment, smaller bubbles are more efficient than larger bubbles, and foot pieces that secure finely divided air streams do deliver greater efficiencies.

At the same time, the proportion of pipes bears on this.

Size of Flow Line

After air or gas has been finely divided into small bubbles and mixed with the oil entering flow line, the size of flow line, or eduction tube, is the one governing factor controlling efficiency most.

Velocity at entrance to flow line should be the controlling velocity, for where wells are shallow, the exit velocity is less than where wells are deep because of the usually greater pressures required for the deeper wells.

Entrance velocity is the velocity of the oil and gas or air mixture and may be held within the usual velocities found practicable in hydraulics, or from eight to 12 feet per second, with 10 feet as an average.

At 10 feet per second, discharge of the quantities of oil shown below are such that the greater number of wells can be pumped with the central air system which, in the writer's experience, is by far the best and most efficient method of pumping, rather than using a central pipe for air or gas inlet and the casing for discharge, for several reasons. One reason is that a smooth interior pipe offers less friction to the passage of oil, and since the velocities at the upper end are great, depending upon air inlet pressure, this becomes a factor that must be considered. Flowing up the casing, around the air line, with air line couplings interfering with easy flow, makes for waste in gas and power.

Should sulphur compounds and the rapid flow of oil and gas or air set up corrosion, a flow line receives this corrosion and the well casing is not damaged.

The uptake area of flow line may be changed more readily than where the size of casing is fixed, thus fixing the uptake area.

Uptake area is a matter of the most concern, for the quantity of oil-gas or oil-air mixture, per square inch of uptake area controls the operating efficiency in equally aerated mixtures.

Table No. 2

Size of pipe—	Capacity of pipe, in barrels of 42 gallons each, per 24 hours, at velocity of ten feet per second.
1-inch	835
1¼-inch	1,251
1½-inch	2,270
2-inch	3,498
2½-inch	5,232
3-inch	7,545
3½-inch	10,252
4-inch	13,406
4½-inch	16,992
5-inch	20,880

This table, from the writer's notes when used in connection with quantities of air, or gas, fixes the size of eduction line, or flow line. For instance, when a working pressure of 300 pounds is fixed, the number of atmospheres of pressure is 21, and the volume of free air is therefore reduced to 1/21. Using say 500 cubic feet of free air or gas per barrel of oil, without considering solubility, whether gas is pumped in or whether it is evolved from the formation, the total volume of one barrel of oil and 500 cubic feet of gas at 300 pounds is 29.3 cubic feet. A well making 1000 barrels in 24 hours then, would pass 29320 cubic feet of gas-oil mixture or 5232 barrels which, at 10 feet per second inlet velocity, would require a 2½-inch flow line.

To pass 1000 barrels of oil up inside of 6⅝-inch casing, with a 2½-inch gas line taking the gas down, means that the uptake area is so great that the velocity is too low for effective work. The velocity should be held high to prevent slippage of gas bubbles through the oil, but it cannot be held too high for the reason that friction increases as the square of velocity. Ten feet per second inlet velocity of the mixture is not excessive, and in short lines of low lifts, may be exceeded, but where the expansion of the number of atmospheres of operating pressure is great, excessive expansion at the upper end of the flow line sets up high velocities that lower efficiency, and where this is the case, enlarged upper portion of flow lines will serve to hold the velocities at the upper end of the piping low enough for good economy.

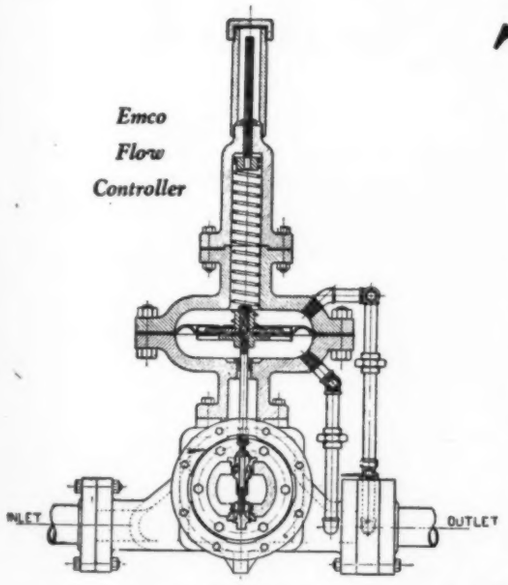
Velocities of 60 to 80 feet per second at the outlet have been observed by the writer, but these are where the gas quantity and pressure are excessive; reducing the gas-oil ratio in such cases not only serves to secure a greater total recovery, but also secures a greater duty out of the gas pumped in. As noted before, however, outlet velocity depends upon the expansions, and these high velocities are not always reducible except by enlarging flow line at intervals up to the surface, for the beginning point is the inlet velocity.

When the standing level of oil in a well has been blown off, and the well is steadily pumping, in an installation as shown on Figure No. 1, back pressure carried on the formation is purely incidental. It can be changed only by changing the quantity of air—more air lowering the working level by greater withdrawal of oil, and less air

Air Lift Operation

REQUIRES ACCURATE VOLUME CONTROL

Perfect Volume Control Is An Essential Feature In the Oil Industries Latest Development



THE Emco Flow Controller is a rugged, fool-proof, sturdy, and simple mechanism giving accurate volume control, yet designed to withstand the rigors of oil field operation.

Volume control is obtained by an accurate differential diaphragm head, operating balanced valves so as to maintain a constant differential pressure across an orifice.

The same design features and construction which have earned for EMCO Pressure Regulators their enviable position as leaders, are used throughout the EMCO Flow Controller.

Simple adjustments can be made for varying the flow of air or gas into the well; a variable orifice (butterfly valve type) and a wide range differential diaphragm spring are provided so that any operating condition can be met.

An EMCO Flow Controller at the intake of the well will insure the accurate volume control so necessary for efficient operation of the air or gas lift.

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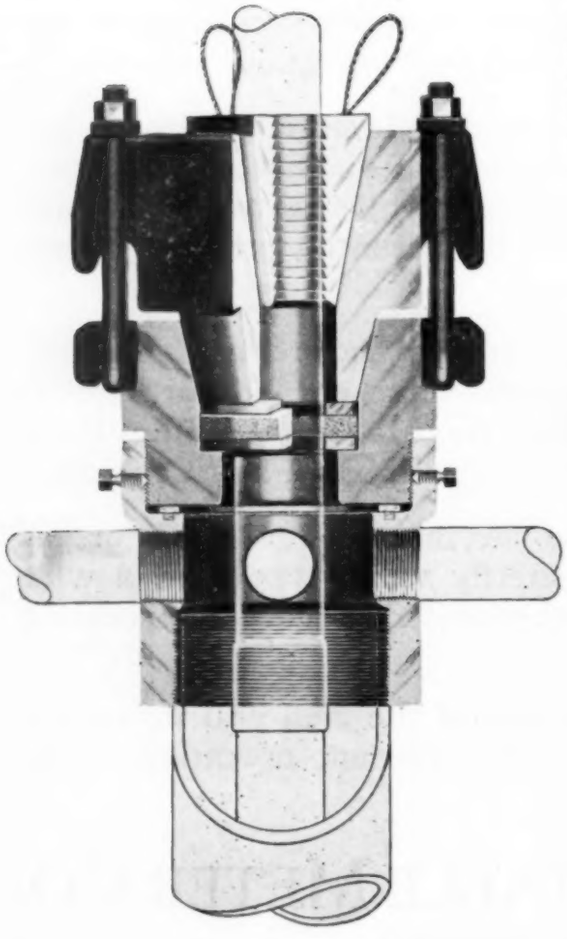

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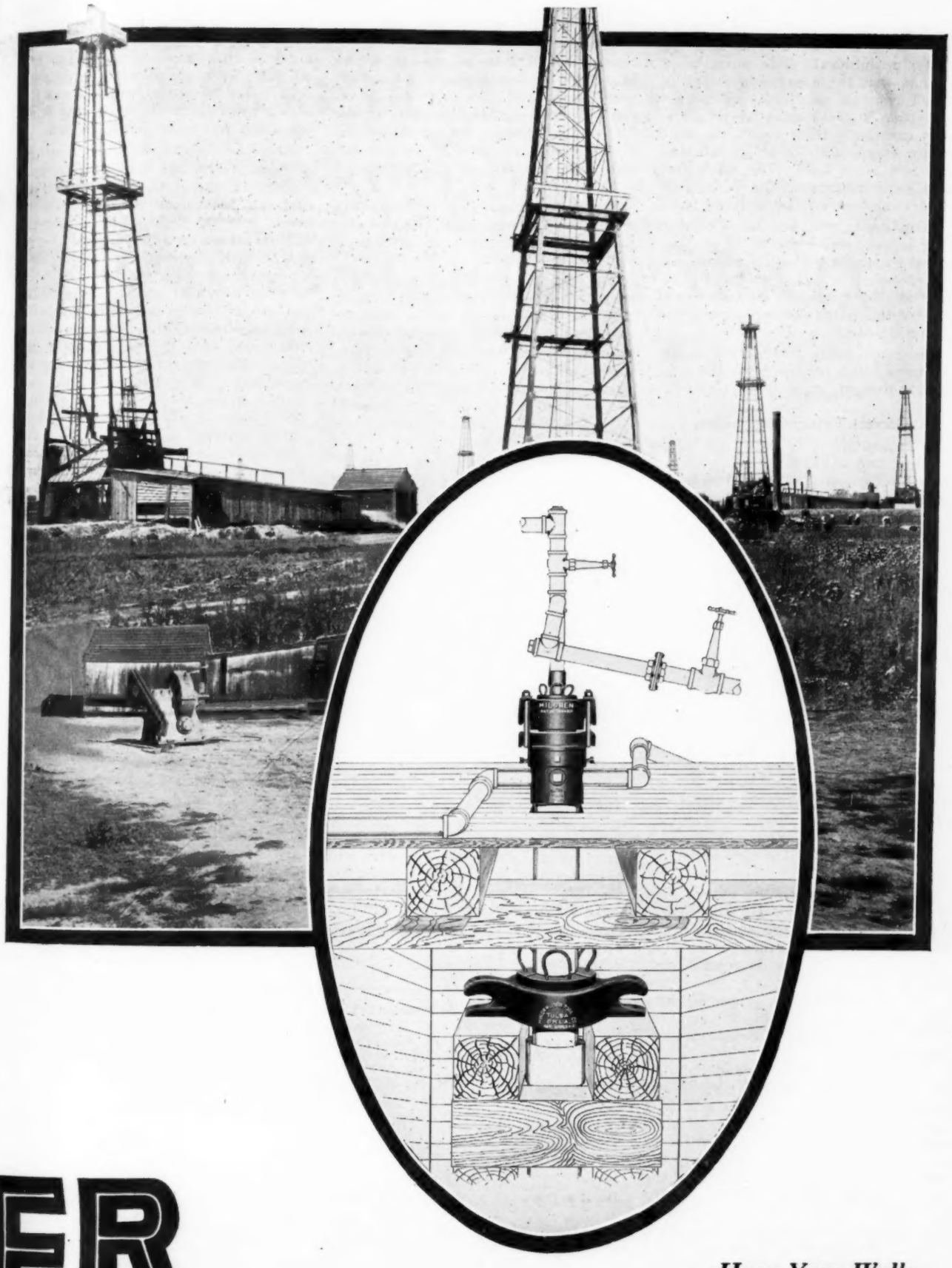

ER

—Have Your Wells Hinderliterized

elevating the working level, due to lesser withdrawal; or it can be changed by lowering the flow line to secure a greater withdrawal. The point being made is that the depression factor of a well controls the back pressure in that when a given quantity of oil is taken constantly from a well, the well, at any stage, will lower its working head to a given level. The method of pumping is immaterial; the quantity of withdrawal controls the working level.

Then, under the conditions stated, there is no positive means of controlling the amount of back pressure, for back pressure in this installation is incidental to the quantity of withdrawal of oil at this particular time considered in the life of the well.

The same holds true of the layout of Figure No. 2, for this bears the same relative design.

Correct Velocity Essential

In Figure No. 7 is shown an inside air line, and in Figure No. 1, air is taken down into a well in the casing, and the oil-air mixture discharged through the central pipe. In the first figure, the pressure of air in the inside line must build up sufficiently to force oil out of the line, followed by air, and when the air follows, it does so in charges, or "gulps" so to speak. Thus, the intake of air is intermittent. Operation of the design of Figure No. 2 is on the same lines of intermittent admission of air or gas.

This method of operation does not mingle the air or gas intimately with oil, and this has given rise to the use of foot pieces of various designs, for, when air or gas has been closely intermingled with oil, the mixture is in condition to afford high lifting efficiency, provided of course that the remainder of the design is correct, for no foot piece can correct all errors of an installation.

For instance, when the uptake pipe is too large for securing sufficiently high velocity, or is too small and the velocity is too high, there is nothing that a foot piece can do toward correcting velocity.

This resolves the air, or gas lift, into just two necessary things—the smallest bubbles obtainable, and the correct uptake velocity.

For securing finely divided bubbles, the writer uses the gas lift pump shown in Figure No. 8. The seat B is run into the well on a string of pipe, and the nozzle C is then run inside of the first line until the lower end of the nozzle rests on the seat, inclosing the space between the two lines. Air or gas is then admitted at the surface to travel down between these two lines, so that the operating pressure may be held independently of back pressure required on the well, and flow of oil-air mixture is up the inner line.

In wells with rock pressure that we wish to hold as long as possible for forcing oil toward and into the well, this foot piece permits pumping with such operating pressure as required by submergence, without interfering with the necessary back pressure for preventing unduly large oil-gas ratios, and in wells where rock pressure has subsided on account of withdrawals of oil and gas, the operating pressure of the lift is not carried on the formation, for the operating pressure is, in this design, independent of the formation pressure.

Some formations will not produce when back pressure is carried for pumping purposes, after the rock pressure has subsided.

The double line design shown has been effective in preventing casing troubles when heated air is used for eliminating accumulations of paraffin and tar in the flow line, for carrying heated air or gas down the outer line, between it and the inner line prevents direct contact of heated air with casing so that casing expansion due to heat is minimized.

A foot piece cannot, within itself, deliver high efficiency without correct proportioning of the remainder of the installation, for, as stated before, velocity of uptake is a major factor. The air lift then resolves itself into a proposition of:

Finely divided air or gas bubbles,
Correct uptake velocities;
Low expansion ratios for avoiding excessive velocities at exit.

And when these are well balanced, there can be but one answer, which is reasonable efficiency.

Surface Plant

Air and gas compression is a subject covered fully in detail and at length in current treatises. Designers of compressors know how to build the machines for sustained operating periods; to proportion the cylinders with correct ratios for efficient work and for safety at high pressures; to cool the discharge without difficulty; to operate the machines at high speeds to secure capacity, and to fuel the engines economically.

The problem of power for air lift, however, is much like the drilling power problem; the requirement is maximum during flush production, and when all wells are drilled, the quantity of air, and the power, reduces, and the requirement for flush production is always too large for settled periods.

The Mid-Continent practice of installing plants that may later be used for natural gasoline plant manufacture, and of recovering natural gasoline while blowing wells, is ideal, for the high pressure air cylinders may be replaced with cylinders operating at lower pressures, single stage, at the proper time. Present practice is to install two-stage machines, with maximum working discharge of 1000 pounds for starting wells. Operating at 200 to 400 pounds discharge pressure, cooling the gas between stages and after the final stage, means that a simple gasoline plant of the compression type has been built. Controlling the design so that cooling coils may be used for absorption plant, and then erecting absorbers and stills afterward, is excellent engineering. A few are doing this now in the first instance.

For serving this purpose, it would seem good engineering to install sufficient large, heavy machines to use as gasoline plant equipment when flush production ceases, and to supplement this type with the lighter multi-cylinder engines of lower cost for flush peak work.

At Seminole particularly, where there is not as great quantity of gas as was found at Tonkawa or at Burkburnett, the great numbers of compressors installed and being installed, will provide far more capacity than necessary for settled work after flush production has subsided, and a majority of these units will necessarily be shut down and moved elsewhere at considerable expense.

The multi-cylinder engine, posessing extreme portability, together with a multi-cylinder compressor, offers the advantages of low cost installation, quick installation, equally as low oper-

ADVANTAGES OF DIFFERENT TYPES OF PRIME MOVERS IN LIFT WORK

	Advantages.	Disadvantages.
Multi-cylinder gas engines of the higher speed type.	Low or no fuel cost. Lowest cost. Portability. Quick erection. Low foundation cost. Low operating cost.	Lesser life than the larger single cylinder engines. Low fexibility.
Gas engines of the heavier, slower speed type.	Low or no fuel cost. Long life. Low operating cost.	Greater cost than multi-cylinder engines. Low flexibility. Slower erection. Non-portable.
Diesel engines.	Moderate fuel cost. Long Life. Low operating cost.	High cost of engine. Higher foundation cost. Low flexibility. Slower erection. Non-portable.
Steam engines and boilers.	Extreme flexibility. Moderate boiler life. High overload capacity.	High fuel cost. Greater foundation cost. Slow erection. Non-portable.
Electric motors.	Low maintenance cost. Low erection cost.	Higher power operating cost. Must be on power line. Interfered with by transmission t oubles. Fire risks.

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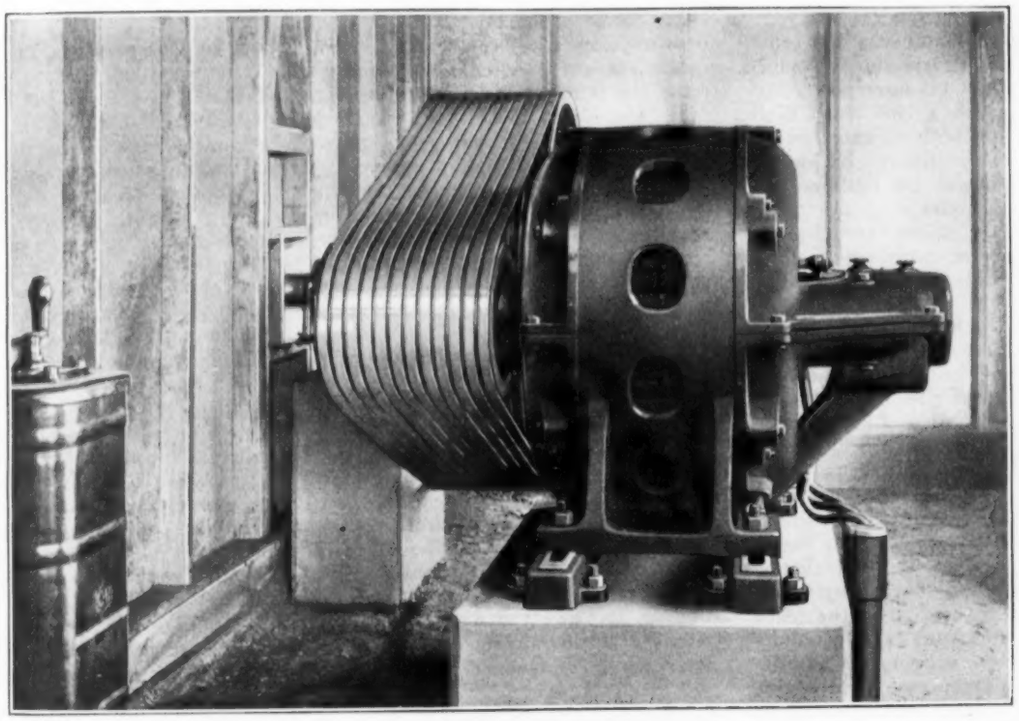

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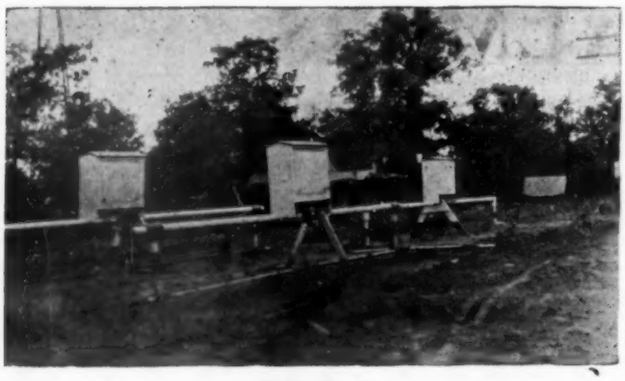

FIGURE 10
Meter station in the Earlsboro field.

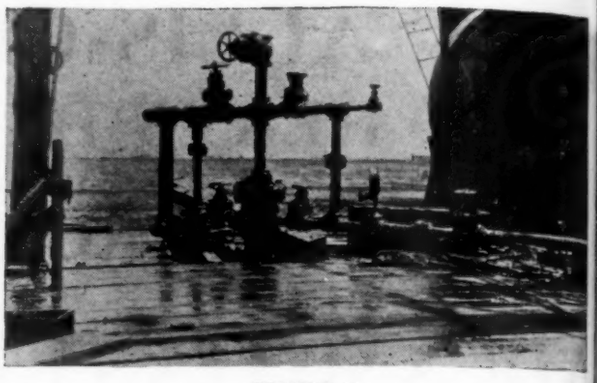

FIGURE 12
Double side outlet hook-up in the Panhandle field.

ating cost and reliability. For this work, the writer prefers the six cylinder engine of about 125 horsepower, directly connected to a two stage high speed compressor, both mounted on an I beam base. This unit can be hauled to the field, slid off on timbers and started in a few hours.

Due to higher speed and lighter weight, this type of compressor offers the lowest capital installation cost.

Power Required

To lift one barrel of 38 gravity oil 100 feet requires 0.883 horsepower of actual work in foot pounds, as shown by Table No. 1. And to lift the same barrel 3000 feet requires 26.49 horsepower of work.

With a plant efficiency of 10 per cent, the plant would therefore be required to develop 264.9 horsepower per barrel of oil and at five per cent efficiency, 529.8 horsepower, so that at low operating efficiencies, the size of the plant and the cost is materially affected by well piping design, distribution line design, as well as compressor and engine mechanical efficiency and compressor volumetric efficiency.

The over-all efficiency is the one measure of actual obtained efficiency, and the term over-all efficiency, according to the writer's views, is that obtained by adding to the power output of engines driving compressors, the power represented by formation gas produced with the oil, allowing formation gas the same unit of compression power per 1000 cubic feet as required by compressed gas, and dividing the sum so obtained into the foot pounds of work done in lifting oil to the surface. In electric driven compressor plants, the consumed power would be measured on the high side of transformers, or where power is metered for payment, which methods include in the computation the motor and transformer efficiency, and which is entirely correct.

This is the familiar wire-to-water efficiency method customarily used in power plant work.

Surface Plant Cost

The question of reliability of compressors is not brought into the picture for the reason that all compressors—anything that rotates and reciprocates—must at some time undergo repair anr renewal and a well designed plant therefore must have reserve units, whether electrically driven, or driven by gas, oil or steam engines.

When sufficient reserve unit capacity is installed, continuity of operation becomes relatively an unimportant phase, although the equipment should be of the best type. There are disadvantages as well as advantages in each type of plant.

Gas engines will not operate continuously, although the writer has had several non-stop runs of over six months; electric motors will not operate continuously, for the reason that lightning, field fires and the like interfere with continuous transmission; steam engines will not operate continuously due to engine and boiler troubles, particularly boiler troubles.

With reference to use for compressing air and gas, the writer has tabulated the accompanying comparison of prime mover efficiency.

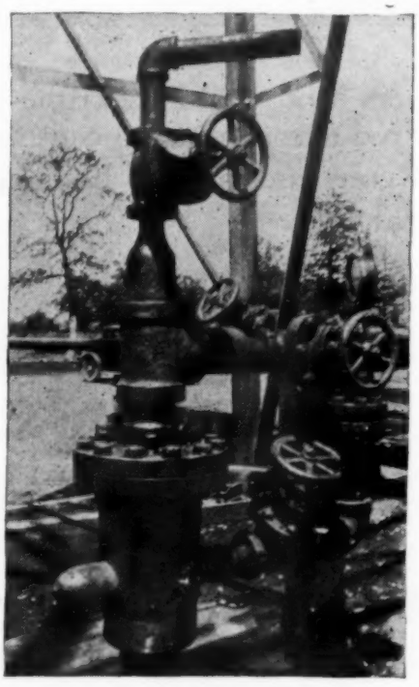

FIGURE 11
Gas lift with Regan well head equipment, Panhandle field.

Cost of Compressors Per Cubic Foot

The installed cost of compressors ranges from $15 per cubic foot of free air delivered in the most favorable locations, using multi-cylinder engines and compressors, up to $20.00 per cubic foot of free air delivered in the larger weight, heavier gas engine driven types.

For instance, a single unit of the latter type, with 15-inch low pressure cylinder, eight-inch high pressure cylinder, 20-inch stroke, two-stage, with 18-inch diameter twin gas engine cylinders of 80 horsepower each, costs $13,000.00 installed, complete; a second and successive units of the same type cost installed in the same plant about $$11,000. With a displacement of 800 cubic feet per minute and a volumetric efficiency of 80 per cent, the cost of air or gas from this machine, per cubic foot of delivered capacity is $20.00.

A 500-foot displacement machine, or 400-foot delivery capacity machine, of the two stage belted type driven by a four cylinder gas engine, costs installed, about $7000.

Conditions are variable, however, and there is no method of estimating the cost of plant without taking the local conditions into consideration.

Cost of Compression

There is no difference in compressing gas for blowing wells or for gasoline plant manufacture, in principle. Working pressures for well work, however, are higher, and the requirement as to pressure varies materially in the same well.

The horsepower requirement for various pressures is as follows:

Table No. 3

Delivery pressure Pounds	Horsepower required to compress air in two stages per 100 cubic feet
200	24.1
300	28.3
400	31.7
500	34.2
750	36.0
1000	38.3

Of course, two stage compression for the higher pressures is not strictly good engineering, but the balancing of cost and maintenance of additional cylinders against fuel costs disclose the cheaper compression ratios. In other words, high power costs call for di-

The

GAS LIFT PROCESS

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UNITED STATES PATENT No. 1,102,152

issued

June 30th, 1914

Sole Owners

JONES-McLAUGHLIN, INC.
850 Subway Terminal Building,
Los Angeles, California

FIGURE 13
Installation of Indian Territory Illuminating Oil Company

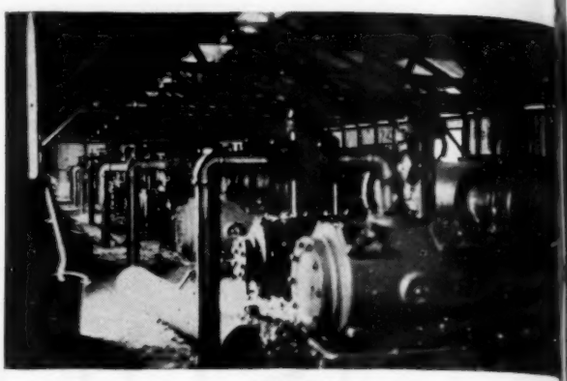


FIGURE 14
Installation in Earlsboro field.

viding the compression ratios carefully, to secure the highest compression efficiency, while, with lower fuel cost, the compression efficiency need not be so high, for the additional machines required to subdivide the compressions set up fixed charges that may offset the gain of higher efficiency. This is true in many power installations, that the very highest mechanical and thermal efficiency are not always the cheapest in the end; rather a high overall efficiency, all charges included.

The cost of generating one horsepower varies with fuel cost, mainly. Current power costs per brake horsepower per hour are about as follows:

Gas engines, ¾ cent.
Oil engines, 1 cent.
Steam boilers-engines, 2½ cents.
Electro power from central station, 1 cent.

Distribution of Air and Gas

Requirement at the well as to volume and pressure, controls the size of distribution lines. The practice of allotting one large compressor, of say 850 cubic feet displacement per minute, arbitrarily fixes the amount of air delivered to each well. It is obvious that, where lines are placed in a well to such submergence depth, that the pressure limit of compressor at speed, is reached, the quantity of air supplied is constant as to volume measured at atmospheric pressure, and also at operating pressure. No group of wells has such a fixed ratio; some wells require more air and more pressure than others, and these should be adjusted to the well.

For instance, with a well operating in a low rock pressure area of the field, the air line would be set deeper, to obtain a constant operating pressure, but, being set deeper, setting up a greater lift in feet, the quantity of air required is greater, than where rock pressure is higher, and the air line is not set as deep.

Lowering the air line at intervals as the rock pressure and consequent static pressure lowers, sets up different requirements as to air and pressure.

In illustration, Figure 9, is shown a set of distribution lines, there being 11 leading from compressor plant to 11 wells, one line per compressor per well.

It would be preferable to increase the duty of compressor plant, or in other words, to lower the cost of compressor plant per well, to install trunk lines—a starting line built for pressures as high as needed—not over 1500 pounds, and an operating line for distribution of gas to wells started. Taking, for instance, a 160 acre lease, these lines would begin at the plant and surround the lease lines with a loop or an endless line, valved so that the supply of air or gas has duplicate lines to each well.

At the well, the supply of gas or air to each well is controlled by throttling through orifices, to the exact pressure and quantity desired. It will be found that the same delivery of oil from a well can be secured with a minimum of plant capacity and that surplus fro all compressors is available for ad tional wells, operating the compress in battery instead of singly.

Making exact calculations of an i stallation of this kind made by th writer, and comparing it with an i stallation where each well has its ind vidual line and compressor, the net re sult is that the horsepower and size o compressor plant may be reduced 3 per cent, which, in terms of cost o compressor plant, is about $3000 pe well for the field named.

In addition, the cost of distributi lines is lower with compressors in ba tery, for equal capacity of small pipe say two-inch, is secured at much les expense with a single larger pipe, i one six-inch pipe has an equal carry ing capacity of 20 two-inch pipes, wi no greater line loss of pressure.

At the junction of line to well wit trunk line, there would be installed a orifice meter for measuring gas taken from any line used for operating.

In 1909 the writer hooked up 29 well to two compressors operated in bat tery, and had no trouble of any kind in apportioning air out of a single trunk line to each well at the pressure necessary.

Gathering Lines—Gas

Naturally, raw gas lines from trap to compressor inlet, are subject to con densation troubles, and the same pre cautions as to pockets in lines that are used in gasoline plant practice are nec essary. Where pockets are unavoid-

FIGURE 15
Pure Oil Company plant in Bowlegs field, Oklahoma.

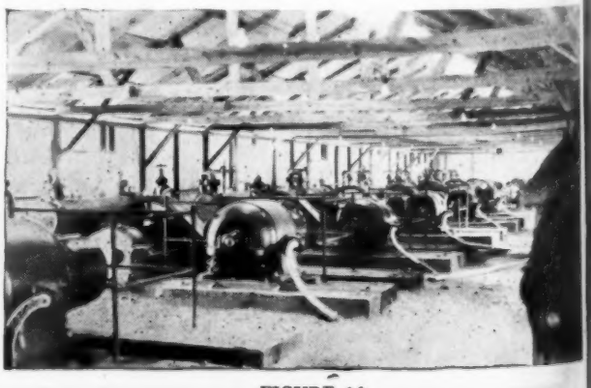
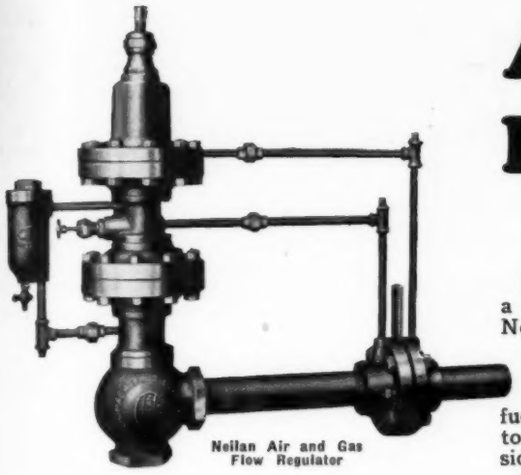


FIGURE 16
Carter Oil Company installation in Bowlegs field.

NEILAN



Neilan Air and Gas Flow Regulator

Air and Gas Lift REGULATORS

A Complete Line for All Purposes

Neilan Flow Regulators: With a compressor connected to a single large header and lines running to individual wells, a Neilan Flow Regulator in the line to each well permits the delivery of the proper amount of gas, automatically controlled, to flow each well according to individual requirements.

Neilan Gas Engine Fuel Regulator No. 17: Will deliver fuel gas to the engines at any pressure ranging from one ounce to 15 pounds; and will handle any pressure on the upstream side of the regulator up to 60 pounds, regardless of fluctuations.

Neilan Gas Regulator No. 10: Will deliver gas to the low pressure cylinder of compressors at any pressure ranging from 1 to 10 lbs., 10 lbs. to 25 lbs., or 25 lbs. to 75 lbs. The regulator will handle any inlet pressure up to 200 lbs.

Neilan Double Cushioned Noiseless Check Valve No. 518: One of these valves installed in the discharge line from the compressor will prevent reversal of flow. These valves have cushion chambers which prevent chattering and pounding. The perfect cushioning, together with rugged, careful construction, insures smooth operation and makes the valve practically indestructible.

All regulators are constructed so that they will not chatter. Dash-pots are not used. Stuffing boxes have been eliminated. Valves are full pipe size area.

Write for descriptive folder for Neilan Air and Gas Lift Regulators for any special condition or requirement.

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Maintenance Engineering Corporation, 2000 Harrington Street, Houston, Texas

NEILAN

Pelican Well Tool & Supply Company, Shreveport, La.

Neilan Gas Regulator for Compressors

Neilan Gas Engine Fuel Regulator No. 17

"You Can Be Sure of Neilan Products"

able, automatic drips must be installed, for, where liquid collects in the line high pressure is built up on the trap until gas is forced through the pocket and in addition, delivery of gas to compressor pulsates as each charge of gas passes through the liquid of the pocket.

Along the same lines of distribution, trunk lines for gathering gas are more serviceable, and less expensive than single lines from well to compressor, and of course, to measure, the quantity of gas delivered from the well, there would be installed a suitable orifice meter where gas from trap enters the trunk gathering line. A meter station is shown in Figure No. 10.

Well Head Equipment

Substantial, well designed well head equipment, in the interest of low maintenance cost, and of continuity of operation, is desirable. Necessarily, the high pressures involved, and the rushes of oil when starting, call for heavy fittings to which no accident can occur at any stage of production.

The illustration of Figure No. 11 shows a Regan control head, fitted to a well for gas lift. There is no stuffing box necessary in this installation, for removal of the bolts permits lifting the inner pipe. The gas, in this design, is taken down the inner pipe and a high pressure globe valve is shown for controlling the gas inlet, with gate valves for the outlet.

This control head has two side outlets for oil and where a well makes sand, both of these are connected up and valved. Figure No. 12 shows the same, with two side outlets.

Hook-Up

The method of hooking up differs with fields, and with operators of the same field. That the practice of hooking from one to five compressors to a single well employs more compressor capacity than necessary is immediately seen, when we know that the air requirement as to quantity varies with each well, especially when tubing is lowered from time to time.

Air or gas may be pumped down the tubing, and the well flowed through the casing, or air or gas may be pumped down the casing and the well flowed through the tubing, or a double line may be run, with air down either the inner or outer lines and oil up either the inner or outer lines. But which method affords the most economy?

In a deep well, operating at say 200 pounds pressure at the plant, with perhaps 150 pounds at the bottom of the well, air or gas, at the bottom is reduced in volume as the number of atmospheres, which in this case is approximately 16, and one cubic foot of air then, at the bottom of the well, expanding gradually as it travels upward, has a steadily increasing velocity, together with the oil. With an entrance velocity of 10 feet per second, neglecting slippage for the time, the velocity at the surface is apt to be near 16 times that at the bottom. With 50 per cent slippage, the velocity at the surface is 80 feet per second, which in hydraulics is an extremely high velocity, and which, in air work in wells, is entirely unnecessary, and too high for efficient work.

But, unless the inlet velocity is held to say seven feet per second, and an average struck, of say 25 feet per second, there is no means of reducing outlet velocity except by employing a tapered flow line, which is seldom done.

Then, these high velocities do prevail in the field, and with them, if the air and oil mixture strikes a coupling every 20 feet, when flowing up around an air line, turbulence is set up, with high friction loss. But, flowing up a smooth interior flow line, this objection is removed, which resolves this question into one of flowing only through a line without any obstructions, or a central flow line.

This eliminates sending air down a central line, and flowing up the casing, for, in addition to the foregoing objection, it will be found in almost all cases, that the uptake area of casing, less the area of the air line, is far greater than necessary for securing a reasonable velocity.

Sending air down the casing and up the central flow line is the next best bet, but, sending air down a line inside of casing, and flowing oil up through a small line inside of the air line, is the best practice, as shown by many tests.

But, where an improper uptake area per unit volume of oil-air mixture is used, there is no hook-up that will prove best. Correct proportions is assumed in this argument.

Rule of thumb, run an air line down and turn the air loose, methods are sure to result in the size of compressor plants being far greater, and the investment far greater, together with higher lifting costs, than where competent, careful, observant, analytical engineers handle not only plant, but well operations. Observing the field in this wise, the cut-and-try method is seen to be the most prevalent and the result is that there are now operating long rows of compressors that will depreciate greatly when shut down after the flush production is off. While the majority of installations are suitable for gasoline plant work, and many are now so being used, still there will be capacity far in excess of requirements for this purpose.

On the Gulf Coast, similar long rows of compressors, with no duty available for them but blowing wells, for no natural gasoline is made there, are subject to the same depreciation set up by standing long periods until a new field calls for their removal and erection on other foundations.

The size of plant may be seen in Figures 13, 14, 15 and 16.

The future of the air and gas lift, as the writer sees it, is particularly in handling deep wells where rods give trouble.

In handling wells making sand, or that should make sand to clear the sand pores of detritus to secure free flow to the well;

In handling production where the daily quantity is too small and the depth too great for economical and profitable operation with working barrels.

And the future depends upon technical skill of design and operation.

Air-Gas Lift Still Experimental in West Texas

(Continued from page 58)

district, but it is not now in use. A few wells were flowed, but the fluid content was too low. Production in one well was increased 150 barrels, but could not be maintained.

The McCamey district has cut oil which presents extreme corrosion difficulties when air is used.

Another good example of a district not suited to air or gas lift methods is the Muenster pool, Cooke County. Low fluid content has also caused abandonment of the attempt to flow wells by air in this field. Strobe & Strobe put in a plant consisting of one Ingersoll-Rand Imperial type compressor, designed to operate at 300 r.p.m., 300 pounds pressure, driven by a 75 horsepower General Electric motor.

No. 3 well, on the Koeltzer lease, was put on air on May 17, at which time it was making 120 barrels. In spite of the air, production gradually decreased so that on May 27 the well was making only 75 barrels. No. 4 was put on a little later when it was making 250 barrels. This well was blown 11 days, at the end of which time it was making 175 barrels. In both cases, very little more oil was obtained from air than could be pumped, but with considerably more expense. So it was decided to abandon the idea of air lift. No. 3 well is now pumping 110 barrels and No. 4, 140 barrels. Cost of putting air into the wells was about $1 per hour, whereas it is claimed that they can be pumped for 24 hours for very little more than that.

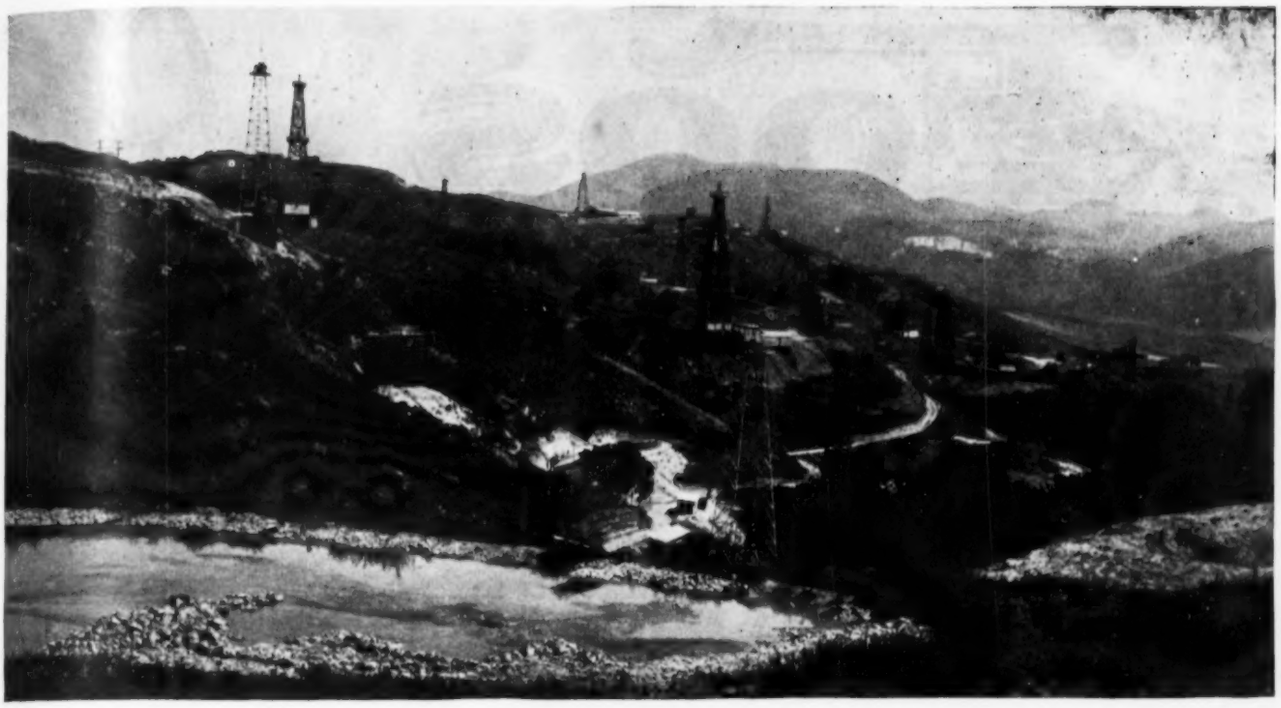
Wells in the Muenster field are about 1660 feet deep.

Strobe & Strobe now use their compressor to lift water from a well which gives up about 5000 barrels daily from a depth of 446 feet.

Dayton pipe line requirements covering couplings, sleeves, clamps, saddles, fittings, and other pipe-line equipment, are featured in a catalog published by The Dayton Pipe Coupling Company, Dayton, Ohio.

Copies of the booklet will be mailed upon application to the manufacturers.

Wilson Oil Tools Corporation, Los Angeles, announces the removal of its offices from Wichita, Kansas, to Wichita Falls, Texas. The office is located at 320 First National Bank Building.



A view of the Cat Canyon field in California

Gas Lift Effective in Handling Super-Viscous Oil

Installation at Cat Canyon increases production and lowers costs of pumping heavy asphalt crude

By BRAD MILLS
Staff Representative

PROBABLY in no other State has more obstacles been encountered in the production of oil by the application of the air and gas lift methods than in California. The nature of the oil, depth of production and the encroachment of sand and water have all offered a series of problems which have been very difficult to solve. Each field has presented a new problem. In many cases, even each well has needed individual attention. What has worked wonders on one well has failed to get results on an adjoining lease. The depth of the producing formation penetration of the sand, the size of the casing, the cleanliness of the oil and dozens of other seemingly minor details have served to bother operators who have worked on the problem.

By far the outstanding achievement in the State is the installation on the R. & G. Oil Company's Cat Canyon lease, near Santa Maria, Santa Barbara County, California, where the Martin-Loomis Corporation undertook early in 1926 to increase production on a bunch of very stubborn producers.

The Cat Canyon oil was so heavy and viscous that it would not flow unless heated. After the oil was pumped from the wells, it was actually raked and shoveled to the crude heating and treating pits. It was very black, with a strictly asphalt base.

The encroachment of sand also presented a very serious problem. Before the gas lift was applied, production ran as high as 30 per cent sand. After the wells were completed, production ran still heavier to sand for several months. The oil was so sluggish that it could not wash out the sand. It merely picked it up and rolled out with it. The separation of the oil and sand was accomplished only after a long, tedious and expensive method, which consisted of heating the oil and allowing it to run through a series of earthen pits.

The wells were producing from a depth of approximately 3000 feet—not considered deep for a less viscous oil but recognized as a pretty good depth for nine or 10 gravity asphalt crude to be pumped. Shutdowns were common under the rod and tubing method of production, often having run as high as 18 days per month on some of the wells. The customary rod and tubing jobs occurred regularly.

In undertaking the problem of supplying the gas lift to the Cat Canyon lease, there was one bright spot, however—the wells were producing no water. The oil was of such a viscous nature, water seemed to have no affinity for it.

The R. & G. Oil Company tired of the expense and trouble of handling the crude and decided to give the gas lift a still further chance to show its worth. Experiments had been conducted before in the field but they had proven unsatisfactory in several respects. It seemed that a straight air lift was out of the question and gas was the last resort.

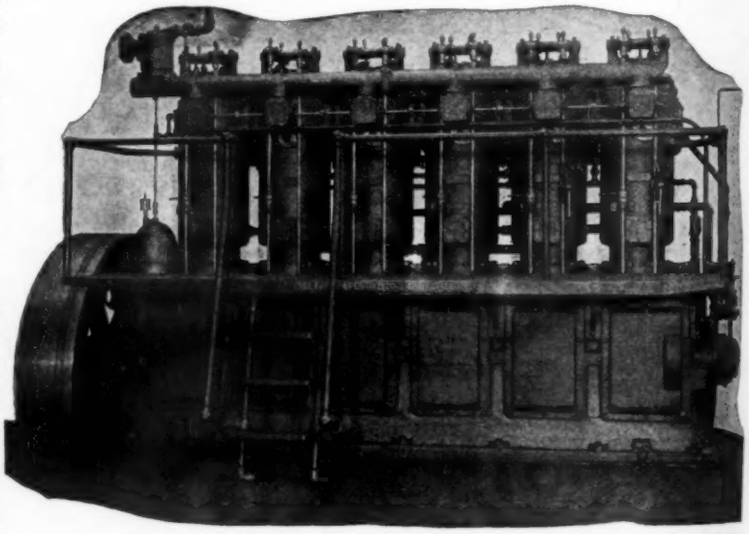
Pressure Regulator

The Martin-Loomis Corporation began installing its gas lift system early in 1926 and completed it within a short time. Only four wells had been completed on the lease and the installation was a comparatively compact and simple one. Besides the usual lead

THE FOOS — Gas drive will be distributed

The Continental Supply Company is pleased to announce an arrangement with the Foos Engine Company whereby we become exclusive Mid-Continent agents for the distribution of Foos Gas Engines for direct-connected and belted compressor drives.

The FOOS Type V Gas Engine, built in sizes of 2 to 6 cylinders for a power range from 50 to 500 B. H. P., has proved through many years of oil industry service an ideal power unit for driving compressors of all types. One of the leading oil companies recently reported, concerning FOOS Engines which had been in operation for 9 years driving compressors in two of their gasoline plants, that these engines have averaged 99.5% operation over the entire 9 years, that 90 to 128-day non-stop runs are not unusual, that the engines will carry 15% overload without a quiver, and that all the units are still running on their original cylinders.



This user has never broken or sprung a crankshaft, and the wear on bearings has been negligible. In general, they are able to operate without grinding valves or other like attention for an almost indefinite period, and find that the units require a minimum amount of attention. The engines are operated continuously right up to speed and rated load, and at least 20 years of service is anticipated.

Require Minimum Floor Space

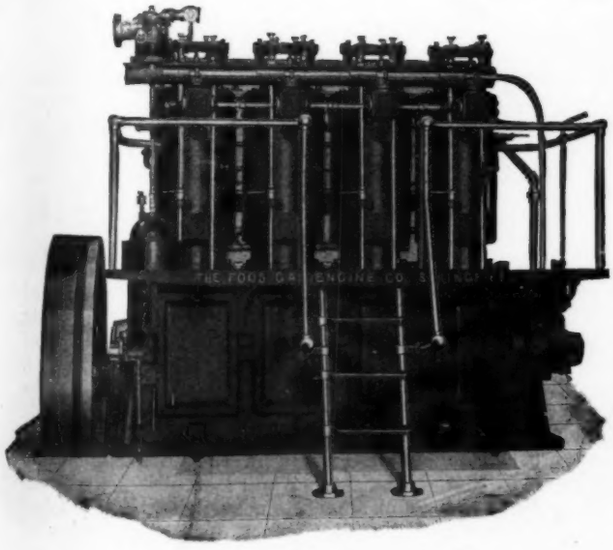
One of the important advantages of FOOS Engines is that, being of the vertical type they require minimum outlay for foundations and occupy minimum floor

CONTI

Engine for compressor through CONTINENTAL-

space. Direct connected to Angle-Compound Compressors, which also require minimum floor space, a gasoline plant power-compressor unit is secured unrivalled for economy of floor space, low installation cost, balance, and general efficiency. Using a building of a given size, a 50 to 100% increase in compressor capacity may be housed, by using this type of equipment.

Another great advantage in this type of Engine-Compressor unit is its salvage value. By merely removing the shaft coupling a separate engine and compressor are secured which can be used for any industrial purpose.



FOOS Gas Engines are built for heavy, continuous duty. Perfection of design and use of the finest materials obtainable, explain their reputation for dependability, low maintenance cost and maximum durability. FOOS Engines are the product of an organization which for more than 40 years has been engaged exclusively in the manufacture of internal combustion engines.

MID-CONTINENT SERVICE BRANCH

The FOOS ENGINE COMPANY now has a Branch Office at 209 E. Archer Street, Tulsa. A complete stock of spare parts will be carried at this branch, and a staff of engineers will be maintained to assist the Continental Supply Company and their clients in working out all details of Engine-Compressor installations.

Inquidies are invited from those planning engine-compressor installations.

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THE CONTINENTAL SUPPLY COMPANY, Ltd.
69 Thomas Block, Calgary, Alberta, Canada

CONTINENTAL

lines, control heads, tubing and return lines, it contained a patented gas pressure regulator control valve and a Loomis gas and oil mixer.

The gas pressure regulator control valve is placed on the return line and was designed to eliminate the necessity for using a compressor for each well operated with gas. It is made with a series of orifices and may be used at any desired pressure, regardless of the pressure of the "common" battery of compressors. With one pressure on the central compressor unit, several wells may have gas applied to them at varying pressures. The built-in orifices regulate the return of gas to the wells.

The oil and gas mixer is a flow device which is placed in the tubing to aid the gas in actually becoming a part of the oil. The gas is forced into the mixer near its bottom and in coming up mixes into a froth with the oil. A given quantity of the heavy, black oil is greatly increased in volume, thereby giving it much less weight. It is then easily forced up through the tubing. The mixer is designed to prevent agitation in the bottom of the hole, which, in turn prevents the disturbance of the loose sand. By sending the gas upward from the bottom of the mixer, the tendency of the well is to flow steadily, rather than by heads.

The original equipment included two Ingersoll-Rand, two-stage 12x6x12 compressors and two 110 horsepower, 13½x18 Bessemer gas engines, but this was later increased to three of each. It was stated at the lease that these engines and compressors had caused practically no trouble since their installation, although they had worked constantly under a comparatively high pressure.

Immediately after the installation was given a trial, the results were astonishing. At last there had been found a way to increase the production and usefulness of Cat Canyon crude. The oil, though difficult to get to market, commanded a premium over crudes of the same grade in other parts of the State. There were several reasons why the R. &. G. Oil Company wanted more oil and they were pleased at their first taste of success.

Production Increase

Before the gas lift was installed, the wells were producing on an average of 100 barrels each. Four wells had been completed and, after shutdowns had claimed their toll, the entire lease was producing less than 10,000 barrels per month. After the gas lift was applied, the production of the wells jumped to an average of more than 200 barrels each and total production from the lease climbed to nearly 30,000 barrels monthly. A fifth well recently was completed and the total production of the five wells now totals around 40,000 barrels per month. There was no tendency for the wells to decrease in production. On the other hand, there has been a gradual increase during the past three months. For some reason, the production started to climb and it has gone upward steadily at the rate of two barrels per day per well per month for more than three months. In other words, the daily production at the end of a given month has been two barrels higher in each well than at the beginning of the month. The exact reason for this increase has not been ascertained. Several adjustments have been made in the surface equipment and this may have added to the efficiency of the installation, however.

The gravity of the oil has been raised from eight or 10 degrees, Beaume, to 12 and 13 degrees. This fact naturally makes the oil less viscous and difficult to handle. The mixing of the gas and oil seemed to break it apart. It is still rather sticky, however, and does not flow freely through pipe lines.

The oil comes from the well in a foamy, frothy state and is fairly easy to handle. The oil and gas are so thoroughly saturated that there is a shrinkage of 65 per cent of volume of oil after it comes from the well. All gauges are taken after the oil has thoroughly settled, however.

The sand has decreased from 25 per cent to less than three per cent after the application of the gas lift system. The volume is now so small, a simple system of flumes will be built to remove all grit in one operation. The volume of sand is gradually decreasing.

Less Sand

When the fifth well recently was completed, the gas was applied, and within three days the sand had ceased to bother. Under the old system, it had taken as high as six months to cope with the sand situation after completing a well. In completing the well, the sand was drilled and crushed to the required depth, with the result that it was impossible to wash or flush the hole, due to the heavy oil. The oil gradually brought the sand up. The gas now seems to allow the excess sand to settle.

Gas production has been increased as the quantity of oil soared. Only enough for actual lease requirements is now being used. The gas possibilities are considered good and the R. & G. Oil Company is now installing a gasoline plant on the lease. The recoverable gasoline averages about seven-tenths gallons per thousand cubic feet.

Shutdowns have almost been eliminated and would not average more than a few hours per month per well. Recently a string of tubing was pulled purely as an experiment, but it was found to be in good condition.

Apparently there is a tendency of the wells to "loosen up" as the gas lift is continued in force. Four months ago three units were running 120 per cent of their rated capacity. Now the same units are running 75 per cent of their entire capacity. The company wished to drill another well but hesitated because the compressors were overworked on the five wells. Another well will be drilled to give the compression plant a full load. The drop in energy required was not accompanied by a drop in production, however.

The cost of production under the old pumping method was 48 cents per barrel, as compared with 13 cents per barrel with the gas lift method. While production has increased considerably more than 200 per cent, production costs, have decreased nearly 75 per cent. Cat Canyon crude is now listed at 85 cents per barrel and finds a ready sale.

Plug Back to Gas Sand on Buttonwillow Structure

Taft, Calif.—The Milham Exploration Company has completed a 10,000,000 cubic foot gas well on the Buttonwillow structure, section 8-28-23, having overcome recent difficulties which almost resulted in the complete loss of the well. The test was originally drilled to 4650 feet, but was plugged back to the 3000-foot level to take care of several hundred feet of gas sand. After the hole was restored to good condition, a string of 11-inch casing was run and perforated from 2350 to 3400 feet . The gasoline content seems to be high.

Permits for New Well in California Hold Steady

San Francisco, Calif.—Permits issued for new wells are running at a steady rate, according to the latest report of the California State Mining Bureau, which has announced that 17 wells were begun during the past week. During the previous week 18 wells were located in the various fields in the State. The recent discovery of gas and some oil near Bakersfield has had a marked effect upon the number of permits issued in Kern County, six wells having been started. The Huntington Beach field bids fair to maintain its present development program, as was evidenced by the fact that four permits were issued for wells in that field. The Long Beach field was the only other field to start more than one well, trailing with two permits. The remaining permits were scattered among the various fields and counties in the State.

Bakersfield, Calif.—The General Petroleum Corporation has acquired the leases of the Southern California Exploration Company on section 5-30-29, near Edison, and will immediately resume operations on a well started on the northwest quarter of the section. The region recently attracted wide attention and several other companies will also drill within the next few months.

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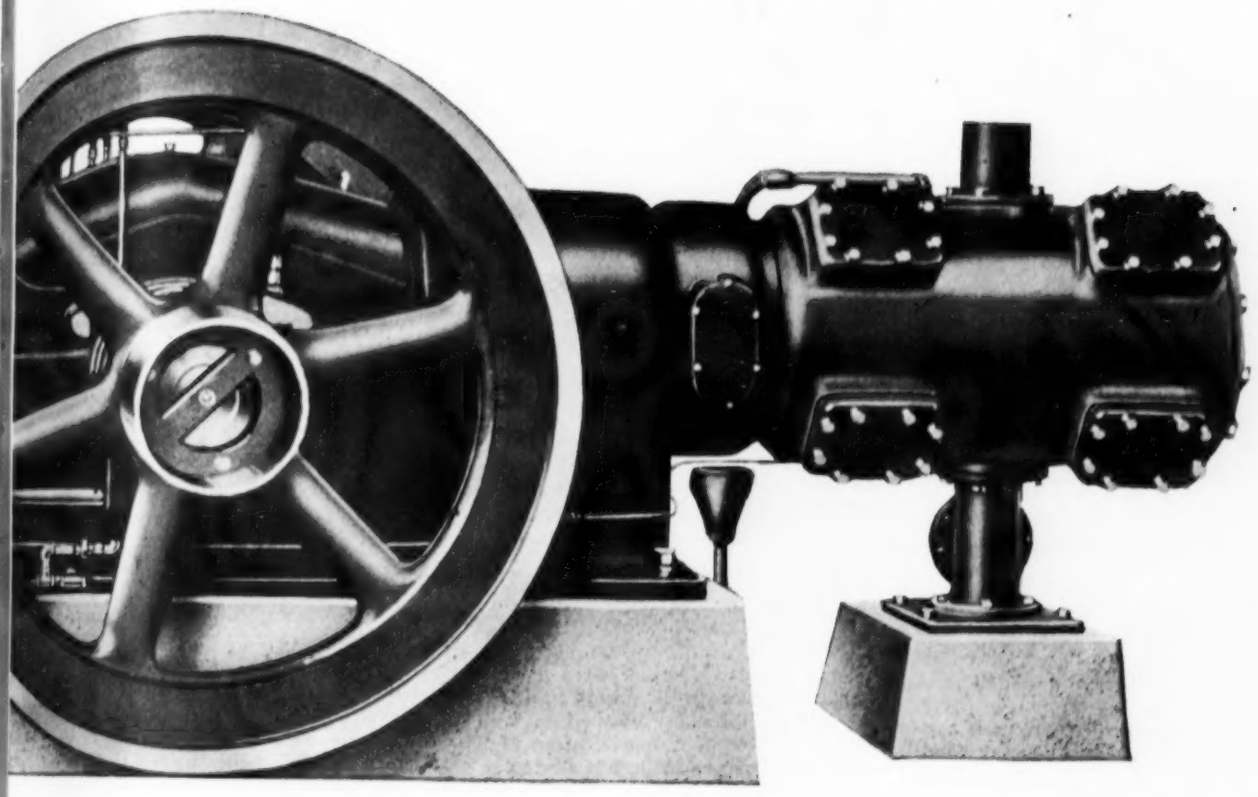

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MPRESSORS

Use of Air and Gas for Lifting Oil Not New Practice

Coastal operators found method successful twenty years ago —small change in equipment

By WALLACE DAVIS
Staff Representative

THE practice of flowing wells by the use of air or gas is as new as it is old. But as a new or recent method of recovery, as many present-day operators are wont to accept it, it will suffice to say that air-gas lift methods were in use under full headway while the industry was trying to get a foot hold on getting oil out of the ground and trying to find practical utilization for it after production.

Air and gas lift development is now at Seminole only because Seminole is new. True enough, Seminole has brought a reformation and a distinct revival of the air-gas lift business. It has been an eye-opener to some operators as to the possibilities of producing oil in large flush quantities, largely because of the prolific sands of that area, and no more than it was to the operators in California and earlier in the Gulf Coast and other sections. So far as Seminole being the first big success in the use of air-gas lift is concerned, history of oil recovery is contradictory, and reveals instances where less spectacular application of the system has been with as flattering success, and with appliances far more in the experimental stage than they are today.

There is no argument against the fact that Seminole has brought out something new in air-gas lift, according to veteran air-gas lift engineers who blew wells with the system back in 1906. As a matter of fact there seems to be no argument against the tehory that every field, where air-gas lift has been in use, has brought out something new, these fellows think—and it's nothing but fair to give them a right to their opinions since they were the ones to conceive the idea of flowing wells with air and gas and since they gave the business its start in a big way.

At Jennings

Air and gas lift methods in oil development found their first commercial success in a big way at Jennings field, Evangeline Parish, South Louisiana—principally air lift, as the absence of gas in the field first gave rise to the demand for some plausible means of lifting the production known to exist there in large quantities, but which failed to flow any more than half way to the top of the hole generally after the gas head had gone off the pool.

They called it blowing wells in those days, and some still do, such as A. D. Murphree and Pete Butaud, who are generally credited with having blown more oil with air than any other two men, and their engineering disciples who followed them, profiting by the many problems overcome by these two men in their efforts to make the air-gas lift successful.

After the gas head had passed at Jennings it was a common thing to bring in wells on air, without bailing them. Oil ordinarily rose high in the holes, sometimes near the surface, and under such circumstances it was necessary only to submerge the air line into the oil body.

Comparisons of the old and the new in air-gas lift show equipment used 20 years ago was not materially different. The description of a Gulf compressor plant installed and operated by Pete Butaud at Jennings in 1907 might well fit equipment in use in the Seminole area today. This plant, the largest at Jennings in the field's flush days, had 11 500-foot Ingersoll-Sergent compressors, two of Ludlow-Dunn, a 500-foot and a 350-foot Gordon compressor, two Rand drills, including a 350-foot and a 500-foot, two American Well Works, 250-foot size, one 750-foot Hall compressor, and one Hall 500-foot duplex.

PETE BUTAUD

Special air and gas lift engineer for the Humble, who has been blowing Gulf Coast wells with air and gas for the past **21** *years.*

Fifty-six 40 horsepower boilers made the power, using 800 barrels of fuel daily, costing at that time 15 cents per barrel.

What Well?

Problems in the old days of air lift were numerous, and the efforts spent to overcome them have gone far toward making the system more of a success today. Veteran engineers who specialized on air lift in the days of Jennings field's boom recall as many problems, major and otherwise, as there were wells. When asked concerning the system of air-gas lift back in 1907, the common reply of the veteran coastal operator was "What well?"

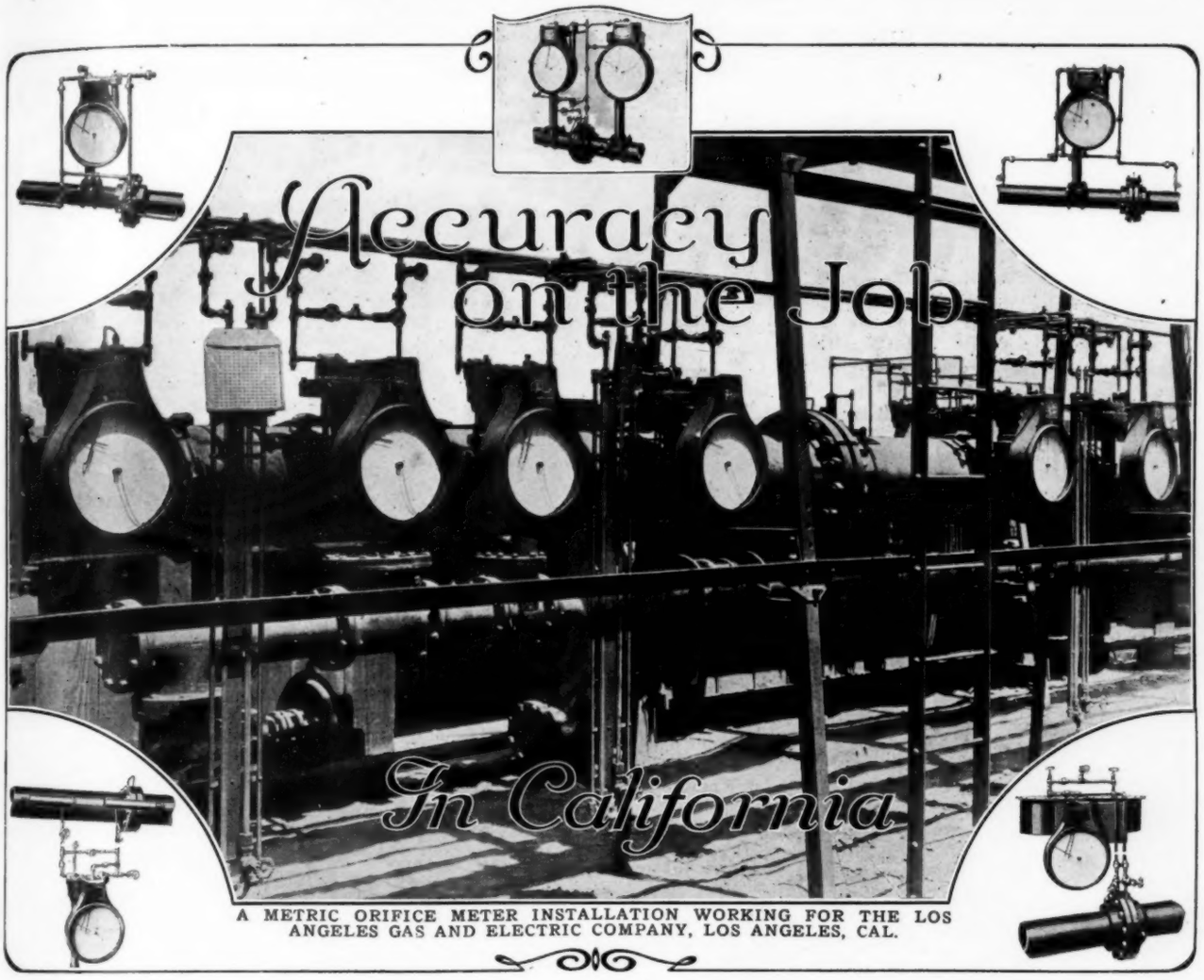
Each well was a separate proposition in itself just as each well drilled in the coast even today is commonly considered a wildcat.

It was common in the early days to find the pressure required to flow a well was greater than the natural rock pressure of the well, which immediately resulted in the fluid being forced back into the sand when the air pressure was started. To overcome this problem a back pressure valve was set upside down in the tubing, ordinarily four-inch, thus allowing the fluid to come in but not to go down.

Early Hook-Up

A popular setting in the Jennings field and also later at Spindle Top following great success at Jennings, was with three strings, 6⅝-inch to the bottom of the hole with an arrangement of two-inch in four-inch, both of which were suspended from the surface to hang loose in the 6⅝-inch. Air was forced in the two-inch to flow the oil out through the four-inch, except in case of only a small amount of fluid when the system was reversed in order to get the greatest return per cubic foot of air run. Except on rare occasions the four-inch would be cut by the continued tremendous force of the air around the bottom of the two-inch. Under the above arrangement of pipe the four-inch could be pulled with little work and expense for replacement of the bottom joint. In this manner the 6⅝-inch casing remained undisturbed throughout the life of the well, whereas the pulling of it would have been comparatively out of reason from the job and pipe expense.

In many places where air is used today a terrific suction is caused when the air is started and the fluid body cut in two, which results in a great danger of sanding the well, especially if the flow



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continues to head as from the natural result of the initial air force. Twenty years ago engineers were overcoming this problem, which presented itself then as now. When the air was started the fluid body was cut in two and the bottom body served as a cushion. When the top body was blown off the pressure on the bottom body was released, resulting in this suction. A system similiar to common pumping methods was installed, having a working barrel attached to the bottom of the tubing with a standing valve placed as in a pumping well. When the air started the standing valve closed and the fluid from inside was blown out through the tubing. Then pressure on the valve was released and the fluid pressure kept the valve open. The idea of the valve was to keep pressure off of the casing and screen.

One of the most economical strings for producing with air in the early days of air methods in the Gulf Coast was an arrangement of a two-inch flow line suspended into the 6⅝-inch casing with a 1¼-inch air line running along side of it and jetting into it near the bottom. This size line was less costly and carried more pressure than the larger air lines. Below the point of connection of the 1¼-inch and the two-inch a nipple was placed on the flow line to regulate the flow and well pressure to the point of making it safe against sanding. Below the nipple was a check valve, which permitted the intake of fluid from the hole but kept fluid from going back into the bottom of the well in case of higher air pressure than rock pressure. In many cases a one-inch line was used in place of the 1¼-inch. In the event of trouble with the system it was only a matter of pulling this combination of small lines, which was suspended loose in the well.

Magnolia Pipe Line Runs Less in July

Dallas, Texas.—Magnolia Pipe Line Company's crude runs from fields in Oklahoma, Texas, Arkansas, Lousiana and Kansas during July dorpped to a new low level for the present year, having averaged 98,173 barrels daily, or 7620 barrels below the average maintained in June. About 80,000 barrels of the daily average crude runs made in July represents crude production of the Magnolia Petroleum Company, and the balance was purchased from other producers. Oklahoma and Texas fields accounted for the loss in crude runs, as minor gains were registered by the other States.

Magnolia's water shipments of crude via tankers and barges from its docks near Beaumont to refining centers on the Atlantic Coast during July reached a new record, with a total of 1,143,822 barrels, as compared to 888,753, barrels moved via water in June. The previous record was made in May, 1927, when 1,002,953 barrels of crude were dispatched from the Gulf Coast terminals. The bulk of this crude is being delivered to Standard of New York, and such heavy deliveries is enabling Magnolia to conserve crude storage facilities for the dull season of the crude market now approaching. Magnolia's water shipments of refined oils (gasoline, kerosene, naphtha, lubes, etc.) during July amounted to 52,772,655 gallons, as compared to 54,653,037 gallons loaded on tankers in June for coastwise and foreign destinations. Fuel oil movement via tankers and barges in July amounted to 8,492,377 gallons, or 5,291,318 gallons below the June movement.

The completion of new loops in the trunk line system operated south from Oklahoma late in July increased the daily capacity of Magnolia's system to 58,000 barrels from Duncan south. About 50,000 barrels of high gravity oil daily is being dispatched to the Coast via this system, since the completion of the loops and enlarged pump station equipment. Magnolia averaged 51,475 barrels daily during July on crude runs from Oklahoma and Kansas, and stored crude in these two states at rate of 4300 barrels daily.

Total crude runs made by Magnolia Pipe Line Company from fields in Oklahoma, Texas, Arkansas, Louisiana and Kansas during June and July follows:

Fields	June Totals	July Totals
Wewoka-Earlsboro	939,134	808,638
Healdton	209,457	212,678
Hewitt-Graham	192,233	184,653
Cushing	151,346	153,303
Yale	64,256	63,256
Seminole	49,741	61,236
Duncan	63,630	54,712
Augusta (Kansas)	47,109	48,915
Walters-Beaver Creek	8,236	8,278
Burbank	.....	85
Cement	1,615	.....
Totals for Okla. and Kans.	1,716,757	1,595,736
Luling	412,575	411,513
Panhandle District	204,268	196,886
Electra	106,833	108,035
Mirando District	96,915	88,658
Burkburnett	80,889	78,439
Archer County	56,543	58,147
Crane County	33,913	44,338
Mexia-Wortham	43,593	44,001
Lytton Springs-Lockhart	37,681	38,147
Howard-Mitchell Counties	25,921	27,635
Desdemona-Comanche	21,339	20,674
Corsicana-Powell	17,061	16,227
Ranger-Olden	12,879	13,072
Stephens County	11,723	10,107
Corsicana (Heavy)	8,999	8,983
Gulf Coast-Spindle Top	13,907	6,061
Petrolia-Clay County	4,939	3,811
Panola County	1,180	1,687
Thrall-Williamson County	1,367	1,224
Coleman County	140	.....
Totals for Texas	1,192,525	1,177,645
Smackover	126,481	127,935
El Dorado	23,029	23,040
East El Dorado	2,587	1,633
Totals for Arkansas	152,097	152,608
Pine Island	37,131	43,596
Cotton Valley	36,712	37,205
Bull Bayou	34,453	33,581
Haynesville	4,124	3,002
Totals for Louisiana	112,420	117,384
Totals for five states	3,173,799	3,043,373

American Government Asked to Again Act In Mexico

Washington, D. C.—Reopening of the Mexican oil controversy threatens again as a result of a visit of a delegation of American oil men, headed by Guy Stevens, director of the Association of Producers of Petroleum in Mexico, to the State Department, where they laid before officials complaints against renewed confiscation of American property rights in Mexico. It is anticipated that the American embassy in Mexico City may be instructed in the near future to enter a protest.

The delegation which visited the State Department was composed of representatives of five companies whose rights in Mexico have been affected, and the protest to the department was prompted by the sudden stiffening of the attitude of the Calles government in regard to those American companies which have failed to comply with provisions of the land and oil laws, under the terms of which they were required to register their concessions with the Mexican government before December 31, 1926, under pain of confiscation. On the advice of the American government, the majority of oil holding owners in Mexico did not carry out the registration requirement and consequently have recently found themselves threatened with the loss of their properties.

Until now the Calles government, although reserving to itself the right to take expropriation proceedings against the American companies, has refrained from doing so in order to avoid open conflict with the United States. Its sudden change of attitude is regarded as an attempt to test the present position of the Washington government, and to discover what course would be pursued by the State Department if full force is given to the laws.

Continental Gets Deep Oil In Santa Clara County

San Jose, Calif.—The Continental Oil Company, by virtue of its recent completion of a 200-barrel oil well on section 31-11-4, has developed the only deep production in Santa Clara County. The well came as a surprise, since all commercial production has come from the shallower sands, which are found around 1500 feet. The Continental landed a string of 8¼-inch casing on bottom at 2603 feet, with 250 feet of perforated included. The company has been fortunate in its California drilling campaign, having made several important light oil discoveries at comparatively shallow depths.

Harry Pennington of the United States Heat Treating Corporation, San Antonio, is on an extended automobile tour of the East with his family.

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Efficiency of Air-Gas Lift Proven At Seminole

Early and universal adoption of the pressure flow method ranks Oklahoma area as scene of industry's greatest experiment

By GEORGE REID
By Special Correspondent

IN the area known as the Greater Seminole field, where the gas lift is directly responsible for the greater part of the enormous production, and where the productive efficiency of the gas lift was definitely proven, both types of flowing by pressure have been employed. By far the greater number of wells artificial flowed, however, have been handled by inserting compressed gas or air into the tubing, conducting it well under the fluid level to secure proper submergence, and discharging through the casing.

Each individual well has proven a distinct problem in itself when the gas lift system has been installed to flow it. In former days before the technology and engineering problems of the system were undertsood it was often very difficult to duplicate results secured on a given well, when its neighbor was submitted to artificial flow methods. It is well known that many companies installed lift systems in late years which were successful in one district, and when the same companies installed the same material, system and devices, and employed the identical machinery and pressures in other pools, that their second venture was distinctly unsuccessful. Such results added additional conflicting data to the ever-growing mass of information available regarding artificial flow methods. The answer of course is simply, "they did not have the same oil wells."

There are many important variables to contend with when flowing oil wells by air methods. With all of our present experience and knowledge of the principles and problems involved, it is still impossible to flow a group of wells successfully with identical equipment, pressures, etc. One group of eight wells on a certain lease are all being produced by pressure methods using natural gas. Each well, as it was placed on the system over two years ago was given individual study and considered a separate problem. The wells flow under the system known as impulse, or intermittent, all of them but one having a mixing device attached at the bottom of the tubing. Each well produces a different amount of oil daily, and returns a different volume of wet gas. Their depths are but slightly different, but the fluid levels of the wells are variable. Naturally the submergence is different. In addition, the valume of gas required to flow the wells varies with each well and the pressure ranges from around 100 to as high as 300 pounds. As the system is of the impulse type, each well receives the full volume of gas required to make it flow about once every 18 minutes. Here again the practice differs with each well, for the pressure is permitted to enter a given well only until it starts flowing, then the pressuer is removed by the arrangement of valves and levers which constitute the intermitting machine, and this time of receiving the gas varies with each well. The lease in question has been producing under gas lift methods for over two years and the production remains within 200 barrels of the production figure of over a year ago.

Such have been the problems of the gas lift engineer, and most of them admit that each well is a separate engineering feat, when it is caused to produce under any of the previously described gas lift systems.

The successful installation has sometimes been discarded or abandoned because the owners estimated that returns were not all that could be expected. Other systems later installed have improved conditions, while on the other hand, the newly installed system has often been disastrous. One well within the writer's knowledge was producing from around 4000 feet on the system of a certain engineer, flowing under 200 pounds pressure at the rate of around 300 barrels daily. This was not good enough. The system was changed to that of another engineering concern who promised much, but never got the well to produce over 70 barrels daily. The owner took it over and through his accumulated knowledge brought production up to around 300 barrels daily until it fell after a few weeks due to a lowered fluid level. He then pumped it for some weeks, and later returned to the original engineering firm who replaced the equipment and flowed it successfully for several months. Twice again this well was changed from system to system, to pump and back to gas lift and the original gas lift engineers now have it again—in answer to a cry of help from the owner. This man's experience indicates that when a good gas lift system is installed and the operation is successful it is best to leave it alone and let it produce.

Compressor Equipment

Compressor equipment must be large enough to perform at pressures ranging from 200 to 500 pounds per square inch. Higher pressures are often required to 'break-out" wells, and compressor equipment must be capable to performing safely at such pressures as 750 and 1000 pounds during the "break-out" period. Some companies doing a great deal of gas lift work install special plants, consisting of one or two large high pressure compression units, which are used only for the purpose of breaking out, or strating the well flowing, after which the pressure is derived from the smaller machine. The general types of compressor equipment have been extensively employed. The larger type and larger capacity is low-speed equipment. The smaller type, as related to displacement capacity, is of the high rotative speed type. In use, these two types seem to be fairly evenly divided. These compressor installations are more extensively propelled by gas engines and electric motors, than by steam and oil engines.

The light, high-speed, multi-cylindered gas motor belt driving compressors, has been adopted in the Seminole area to a large extent. One of the prime considerations in the installation of compressor and engine equipment is that of portability. In the Seminole fields, where installations were hurriedly constructed and installed during the late fall, winter, and spring of last year, and compressors, engines, etc., were brought into the area by the scores, not to say hundreds, during the height of development then the matter of portability was, if not essential, at least very important. In other fields, where the writer has visited, gas lift surface equipment has been generally a little larger and heavier than at Seminole.

No Harm to Sand

Engineers are virtually agreed that the gas-air system as installed and operated so extensively at this time, can do no harm to the normal oil bearing formation. Many engineers and operators agree that the pay horizon is more completely drained, and more ultimate recovery is secured by gas lift methods

than by pumping. It is certain that the flush production is drained in a shorter period and with larger production thus secured lifting costs are greatly reduced. Labor is reduced, and pumping equipment is also reduced, although often left intact as auxiliary equipment. One of the greatest advantages of the gas lift system of production is that of conservation of the gas. This gas, in addition to being conserved, is used as a carrying medium for gasoline which is stripped from the gas by the absorption or compression plant when it emerges from the well enriched through its contact with the oil. The application of air or gas lift permits better control of production of either water, gas or oil.

The Seminole area may well be termed the oil industry's greatest experiment because of the abrupt departure of the operators in this district from his traditional methods of lifting oil and the extensive development of the air and gas lift method which has lately become known as "pressure flowing." In this field the application of mechanical stimulation became widespread during the first few months of the field's development. Prior to the earlier experimenting of a few companies in the Seminole City pool, operators were undecided as to which method should be followed in lifting the oil from wells that soon ceased to flow naturally because of the lack of natural gas. Early installations of the air lift were startlingly successful, and with the result that the air lift engineer was able to produce for his company about four times as much oil in the same period, as his neighbor was producing by pumping or swabbing. Thus a 1000-barrel well should become a 4000-barrel producer inside of a few hours after the pressure was applied. Such was not always the case, for many wells did not produce four times the former quantity when placed on air or gas pressure, but the majority placed on air and gas had quit flowing completely. What the pump would have done on those wells will never be known, for the oil was rushed to the surface through artificial stimulation. The air-gas lift systems were proven of their success, economy and ability to serve, the mystery surrounding the system was entirely removed and operators and engineers exchanged needful and helpful information regarding the so-called "new" method, to the end that the entire group of operators at Seminole all profited again by co-operation and discarding of secrecy as to their operations. Well over one-half of the flood of oil at Seminole has been produced by the air-gas lift installations in the field, some estimates indicating around 60 to 65 per cent production by the lift.

Eliminate Angles

Gas lift engineers in the Seminole area have proven by repeated demonstration that the elimination of angles and sharp turns in the flow lines leading from the well head to the separators or traps, is a very important consideration. In other words, late efforts have been toward the removal of sharp turns, so that when the fluid discharges from the casing its course of flow may be as straight as possible to the point of discharge at the tank or separator. In many instances separators have been placed very close to the derrick and erected as high as 20 to 30 feet in the air, so that the discharge from the casing will be very nearly vertical from the derrick floor to the separator where the fluid is discharged, for the purpose of creating as little friction as possible and to keep the oil and gas, or air and oil in suspension or intermixture. Where horizontal lines are used the gas has a tendency to rise to the top with the result that the movement is slow. Sharp angles being eliminated the surface equipment causes little back pressure to be exerted against the flow.

Discharge lines leading from the separators are also made very large, often eight or 10 inches, depending upon the amount of fluid to be handled, in order that there will be no back pressure created on the trap, and consequently upon the sand. Some distance from the trap these large lines are reduced to the usual size of pipe line required to handle the volume of oil produced in conducting this oil to the flow tanks. Operators using this type of hook-up install one small separator at each flowing well. Other operators do not regard the possibility of back pressure with as much seriousness and conduct the production from a number of wells to centrally located separators of large dimensions. Often these large separators handle the production from as many as four wells. In the event the wells are flowed by air pressure the separated air (and some gas mixed with it) is conducted away from the trap and up into the air 30 to 50 feet and dissipated into the atmosphere. Where pressure flowing is accomplished by means of compressed natural gas, the gas from the separators is conducted to the nearby compression plant, where it is recompressed, cooled and the condensed gasoline removed, and the gas is recycled into the oil bearing horizon. This recycling results in the enrichment of the gas to the point that more gasoline is extracted upon its return trip. Several companies have erected large absorption type natural gasoline plants which served for the dual purpose of extracting natural gasoline for profit, and to avoid this gasoline collecting in the lines about the lease during cold weather. This type of installation often results in the gas being first compressed to 30 to 35 pounds per square inch for passage through the absorption plant and then again being recompressed to 200 to 300 pounds pressure for insertion into the wells.

Measurement

Operators in the Seminole area were early to realize the necessity of accurate measurement of gas compressed and injected into the well, and the careful control of pressures used in flowing. The practices of individual operators differ in the matter of installing meters for the measurement of gas, some placing the meters close to the well, housing the delicate instruments in specially constructed box-like houses. Pressure gauges are placed at the well head and at the compressor plant. Accasionally the pressure gauges are of the recording type, and all meters are chart recording. Other operators build centrally located control houses in which all meters and like instruments are housed.

Automatic recording control instruments are extensively employed. In the centralized control house such equipment is protected during winter months by the enclosing walls and roof and the additional protection of steam coils for heating purposes is provided. In such an installation the manifolds through which the flow of compressed air or gas is directed to the individual well from a header arrangement, are located just outside of the control room. This style of installation has the advantage of perpetual close observation of the actions of each individual flowing well, since the operators at the control house work in three shifts during the 24-hour period. Hourly records are kept, which provides for closer contact with the problems confronting the gas lift department. Metering and control records are very beneficial in computing costs of operation, gas-oil, ratios, and for comparative references when making future installations of the air lift. Not only is the gas or air metered into the well, but a second meter is placed on the outlet line leading from the separator which conducts the gas back to the compression plant. Some operators also meter the air leaving the traps before it is vented into the atmosphere.

Automatic control instruments which are installed on individual lines leading to separate wells are now finding application in the Seminole field. These instruments, which control the volume and pressure of the gas entering each well, permit the use of several compressors discharging into one header line, making it possible to handle several wells from a single compressor installation. This work is similar to that which has been carried on by one engineering company in California for the past three years and is no innovation in gas lift work. The device as used on the West Coast is a valve, adjustable to a wide range of working pressures and controls the volume of gas permitted to enter each well at the predetermined pressure by the simple regulation of a series of orifices of which the valve is composed, making

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it possible to operate several wells from one compressor plant with all compressors working at the same pressure, discharging into a header, and the varying pressure of the gas entering each well is controlled and regulated by this type of valve at the well. Or stating it differently, any number of wells may be operated and flow at different pressures from one compressor by using the pressure regulator control valve.

The Seminole automatic volume control meter, accomplishes the same results, controlling the volume on separate lines leading to separate wells, with all compressors in the pressure plant operating at the same pressure and discharging into a header line. Both the California device and the one gaining much use in Seminole work to assist the operator in getting away from the "compressor per well" type of installation, and both are of value when the wells reach the low production stage. Several small producers may be flowed by such pressure methods with fewer compressor machines. This permits the operator to move unneeded machines to other fields to flow other wells by the gas lift.

Tapered Tubing

Another item of importance, usable in conjunction with the valume control metering instruments, consists of the use of tapered tubing in the wells as they enter the class of smaller producers. The tapered tubing feature, which is being used at Seminole, consists of using tubing strings which gradually become smaller in diameter as the string approached the top of the hole. The gradual decrease in the size of the tubing effects a confining of the working energy of the air or gas instead of permitting it to become exhausted as the mixture rises in the tubing. This really causes the compressed pressure medium to retain greater working capacity or energy higher up in the hole. The use of such tapered tubing is not general. Some operators have tried the reverse of the tapering, putting the smaller diameter tubing at the bottom instead of at the top, in the hope of reducing back pressure on wells of large capacity. Tapering as described above is used where wells have reached a comparatively low production figure. By its use, however, the number of compressor machines employed per well have been reduced. Where wells become producers of the 50-barrel type, it is thought that by the use of the tapered or graduated tubing feature, and individual volume control meters, or pressure regulating control valves for each line leading to individual wells, that several of such wells may be profitably flowed by gas lift methods, and using a much smaller number of compressors. Such work has been found practical on the West Coast and no doubt the operators in the Seminole field will adopt such practices widely as the many wells drop off in oil production.

Corrosion

When wells in the Seminole area began producing water it was found that a certain chemical reaction was assisted by the presence of air (used for pressure flowing) with the magnesium and calcium in solution in the water The result was manifest in the form of badly corroded casing and tubing. This development was to some measure overcome by changing from the air lift to gas lift, thus avoiding the chemical reaction by replacing the air with gas and in such manner avoiding the corrosion of the casing and the attack upon the outside of the tubing string. In other instances it has been found profitable and practical to change the method of applying pressure, and to introduce the compressed air into the casing and force the flow of liquid and air out of the tubing. In this second method corrosion was not overcome nor prevented but a saving in money and time was effected, namely, the difference between the cost of two and one-half-inch tubing and six and five-eighth-inch casing, aside from the saving in time in pulling and replacing but one string of pipe instead of two.

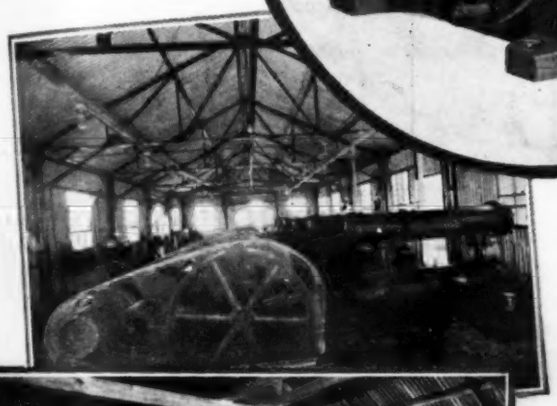
The life of an oil well in Seminole operating on the gas lift method of production, is of course, governed by the usual variable factors. It depends somewhat upon the amount of recoverable oil per well in each of the producing fields. This ultimate recovery factor cannot be arbitrarily determined. Some operators estimate that the gas lift is removing in one year an amount equivalent to that which the pump would produce in four years. Average life of a number of wells has been 10 months to a year. This again is influenced by water encroachment. Engineers differ as to the influence of the gas lift regarding water, some maintaining that the lift deters water encroachment in its application, while others affirm that the gas lift hastens the encroachment of water and lessens the productive life of the average well. Some companies have abandoned wells as non-productive due to low yield of oil or to the increase in water production. Since there is no method of determining an oil well's ultimate production until it has yielded it, then this question of total production under gas lift methods as against other methods is difficult to answer. Many operators maintain that the break is about even, and that gas lift methods in Seminole are producing the equivalent amount of oil in about one-fourth of the time that a given well would produce on the pump. Some wells in the Seminole area, where hole conditions are right for pumping equipment, have been taken off the pressure flow and converted into small pumpers.

The cost of installing gas lift systems in the Seminole field has varied with the type and size of equipment used. It is estimated that each well flowing under pressure is equipped with two compressors. The cost of piping gas to the well, oil to flow tanks, and gas back to the compressor plant is dependent upon the distance of the wells from the compression plant. Control instruments, meters, pressure gauges, and other such items add to the cost of the installation according to the number and type of such instruments used. Some companies estimate the cost per well as much as $20,000, while other, flowing a larger number of wells from centralized plants have reduced this figure as low as $8000 to $10,000. In comparison with this cost it is of interest to cite the practice of one large company operating gas lifts in the Torrance field of California, flowing wells at equivalent depths of Seminole producers. This company installs one small compressor, driven by electric motors, locating the individual small compressor plants very close to the derrick and installing the entire system at a cost of less than $5000 per well. The cost at Seminole as variously estimated by many companies will be somewhat reduced as other neighboring fields are developed, for as wells go off production and are abandoned or placed on pumping equipment, then this material, such as compressors, motors, pipe lines, fittings, control instruments, and so forth, will be transported from the old territory to the new area and used to flow additional wells until they, too, have reached the point where they are no longer sufficiently productive to warrant pressure flowing methods.

Operation Factors

The gas or air lift installation of surface equipment requires only the compressor, lead lines to the wells, with meters of volume control instruments measuring and controlling flow of compressed pressure medium to the well. Air or gas is discharged into the tubing string at pressures ranging from as low as 150 pounds to as high as 500 pounds per square inch—taking the field in general. The pressure is governed by the amount of gas required to cause the well to flow, and this volume, which in most wells, is a delicate factor and must be carefully handled, is controlled within close limits either by automatic control instruments, or, occasionally, by hand manipulation of valves, etc. The volume of gas or air required ranges from 300,000 to as high as 1,000,000 cubic feet, though the latter high figure is exceptional, as it is the low figure, 500,000 to 800,000 cubic feet, are better figures for the mean.

As much submergence as is possible desired by nearly all engineers handling the gas lift problems at Seminole. This means that the higher the fluid level, the better they like it. One engineer states that he secures better results with as much as 1500 feet submergence, but that wells will flow very satisfactorily with less. The tubing string is carried a few feet deeper than the casing string. Oil is then forced upward to the surface through the annular space between the casing and tubing. It may be stated that general practice in the field consists of using six and five-eighths-inch casing and two and one-half-inch tubing, although this is not an arbitrary statement. When



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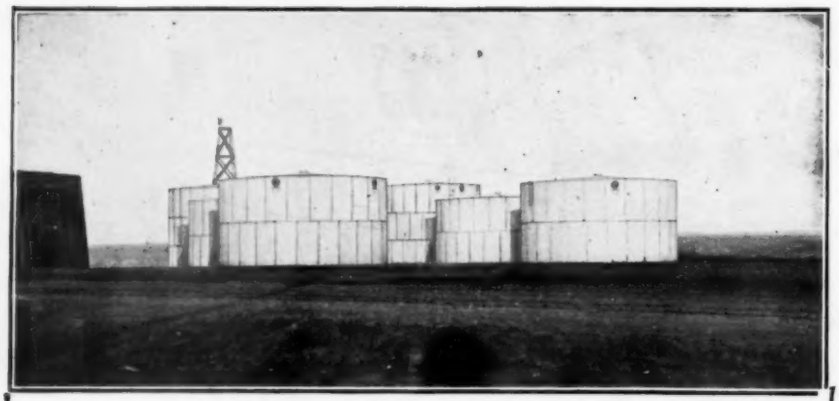

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Illustration shows one 500-barrel and four 1,000-barrel MALONEYS at the Drumright pumping station of the Pure Oil Co., Pipe Line Department.

"Alone In Quality"

Howell Aluminum "3 in 1" Vacuum Pressure Valve and Thief Hatch—The BEST and LATEST Deck Equipment—POSITIVE Safety

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MALONEY

the mixture of oil and air, or oil and gas, arrives at the surface it is separated through the conventional type separators. If the well is operating on the gas lift, the separated gas is measured through orifice meters. If the air lift is employed the return air is led into the air and dissipated—usually without measurement. The measurement of this air would be of assistance in arriving at gas-oil ratio figures, useful for comparative purposes with the gas lift. The lines leading from the traps are equipped with check valves, hand or wheel valves, as a safety measure.

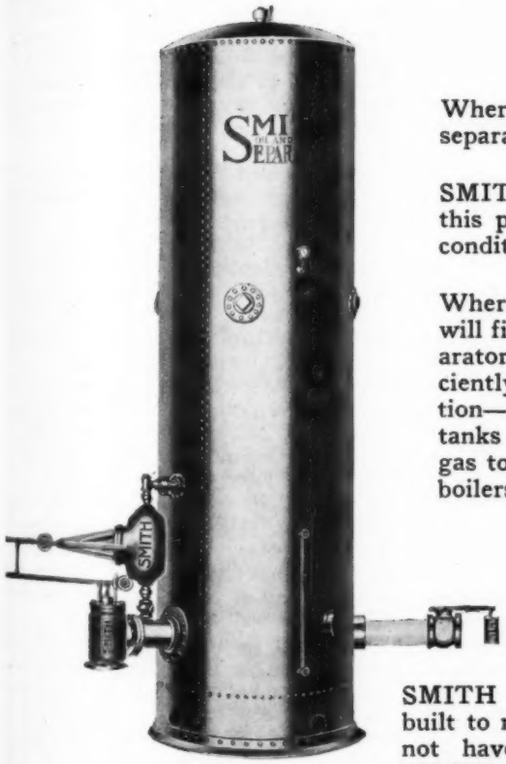
The many compression plants in this field ore equipped with practically all types of machines. These machines are operated by electric motors, belts driving the compressors, also by gas engines direct connected and belt drives. Gasoline engines are used in some plants. A few plants are steam driven, but steam is not so widely used as is the gas engine and the electric motor.

A large number of compression plants are constructed in such a manner that they can be readily switched from the compression of natural gas to the handling of air. Such plants must have two manifolds for proper distributing, and most of them have the lines painted in such a manner that the gas system is easily kept separated from the air lines. When these compressor installations are handling natural gas they are productive of natural gasoline because of the pressure necessary to operate the gas lift systems and the richness of the gas. Such equipment as accumulator tanks, etc., from which the condensed gasoline is blown to storage is therefore provided when the plant is erected.

The natural gasoline industry has long practiced the scrubbing of gas prior to compression. This cleansing of the gas is of much importance and is generally recognized now by gas lift engineers and operators. Much trouble with compressor valves, pistons, etc., is avoided now, which was incurred with some earlier installations and loss of running time and expense of repair is eliminated by the installation of simple scrubber tanks which guard against the entrance of sand and scale into the machines. Plants running on recycled gas coming directly off of the separators find that by installing scrubbers that the possibility of getting liquid into the cylinders where it might easily cause serious damage, is avoided. The tank must be of sufficient size that the gas upon entering the tank, will be sufficiently reduced in velocity to drop any entrained fluid or scale or other foreign matter before reaching the compressor. Plants running on air are installing efficient air filters on the compressor suction for the same reasons.

R. J. Metcalf, Texas division chief geologist for the Transcontinental Oil Company with headquarters at Fort Worth, has been at Colorado Springs, Colorado, for the past several weeks owing to the illness of his wife, who became sick while visiting the latter place.

Smith air and gas lift SEPARATORS



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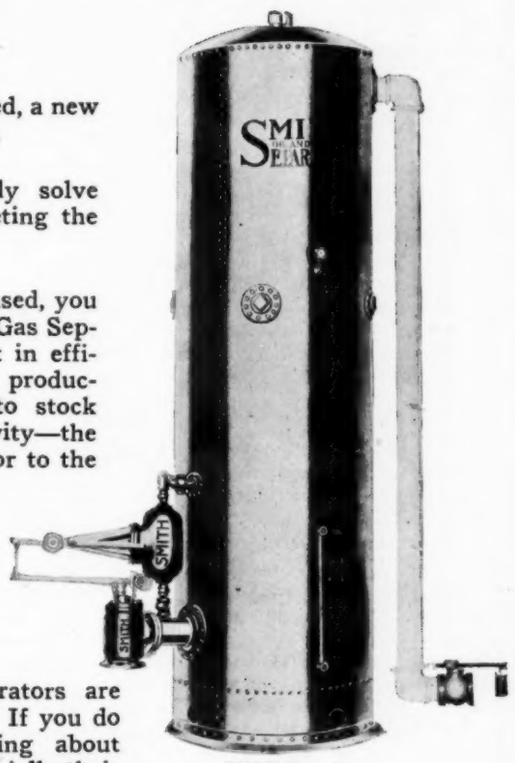

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Say you saw it in The OIL WEEKLY

Casing Trouble Delays Testing of Well Near Bakersfield

Seal Beach production goes up 5000 barrels despite only four completions and number of wells off

By BRAD MILLS
Staff Representative

LOS ANGELES—Culminating a series of mishaps, the Pacific Eastern Production Company may be forced to abandon its Union Avenue well, near Bakersfield, due to a break in the eight and one-fourth-inch casing and the freezing of the six and one-fourth-inch oil string.

A production test was practically under way when it was observed that the eight and one-fourth-inch was leaking. Every effort was made to pull the six and one-fourth-inch oil string to get at the trouble but it was found frozen tight near the bottom of the hole. It was unscrewed at 4331 feet, however, and pulled. The eight and one-fourth-inch parted completely at 2875 feet. This string will also be pulled. An effort will be made to run both strings back in the hole and connect on to the casing left with special connectors. If this is successful a production test will be made.

Due to the high gas pressure, water trouble and mechanical difficulties, the Pacific Eastern Production Company has had many problems to overcome since the well startled the oil fraternity three weeks ago by blowing in as a large gas well. The well was stopped at 4392 feet and has produced at the rate of nearly 10,000,000 cubic feet of gas daily and approximately 50 barrels of 22 gravity oil when allowed to flow at full capacity.

The discovery precipitated the most extensive leasing program ever waged in the bed of the San Joaquin Valley. The gas tests dry, but the largest operators have ignored the fact in their search for desirable acreage. The excitement has been dampened somewhat by the failure to make the discovery well an actual oil producer, but acreage is still changing hands several miles from the well. Very little oil has been found at a distance as far from the hilly edges of the valley.

Abandonment of the well would stimulate rather than retard development on the structure. Other companies are awaiting the outcome and would rather not drill as long as the Pacific Eastern well is in a questionable status. The actual abandonment of the well, due alone to mechanical difficulties, would undoubtedly lead to the drilling of several other tests within a radius of two miles. Many of the companies were fortunate enough to secure leases without a clause for immediate drilling.

Seal Beach Up Again

The Seal Beach field continued its puzzling gyrations, with a 5000-barrel increase during the week. Production is again running above 59,000 barrels, after having touched 54,000 barrels during the previous week. The increase was brought about with the aid of only two completions and two re-completions. It was readily apparent that the older wells stubbornly resisted any tendency toward a decline. Several idle wells were put back on production with good results. Fewer wells were producing at the end of the week than at any time for several weeks, however.

The deeper sands in the field undoubtedly offer the best chance for any marked increase in production. New wells completed at nominal depths do not seem to have the lift the first wells displayed. On the other hand, the old wells that have been deepened and re-completed have shown as high an average as the original shallow wells. Many wells are being killed and will be carried down to the bottom of the Selover sand. This accounts for the fact that fewer wells are now producing than were on production a month ago.

Whether or not the Wasem sand would be picked up under the main part of the field has never been settled. Recent re-completions seemed to have found production in the bottom of the Selover, rather than in the Wasem sand, which has been identified only outside the principal producing sector. The General Petroleum Corporation has developed a production of nearly 1000 barrels in its Wasem 2. Since the Selover sand was not picked up in the General Petroleum Corporation's wells, there is some reason to believe that the formation is a distinct one, despite the fact that other operators have not announced the discovery of the zone in the center of the field.

The California Eastern Oil Company added 2200 barrels to the production of the field by re-completion of Graves 1 at 5215 feet. The depth is exceptional and adds a touch of seriousness to the rumors that the deeper sands will cause an upset during the present month. The crude tested 26.4 gravity, which was a rather low figure for the increased depth.

The California Petroleum Corporation completed its Bailey 1 as a 2100-barrel well at 5300 feet. The oil tested 27.8 gravity but shows a cut of six per cent. It was one of the deepest completions in the field.

Richfield Buys Holdings

The Richfield Oil Company of Los Angeles has purchased the holdings of the Delaney Petroleum Corporation in the Long Beach field and through the transaction has become one of the largest producers in the field. The present production from the leases is upward of 4000 barrels, and it is believed that by cleaning out and deepening some of the older wells, this may be increased materially. It was announced that several wells were being drilled on the acreage and it will be possible to make additional locations. The purchase price was not made public, but it is understood to have run well above $2,500,000.

The Standard Oil Company completed two average wells in the Huntington Beach field during the past week. They were Pacific Electric 9, completed at 4329 feet with an initial production of 370 barrels, and Pacific Electric 10, which was completed as a 400-barrel producer at 4350 feet. There was a wide difference in the gravity and quality of the oil, the former yielding a 27.3 gravity crude which cut three per cent, and the latter producing only a 23.2 gravity product with a cut of less than one per cent. The Globe Lease & Royalty Company completed its second well in the field as an 80-barrel producer at 4345 feet. The company's first well was a much better producer than its latest completion. Despite the poor showing of No. 2, the company will drill a third well on the lease.

The Shell Company has completed its Orange 15 in the Brea-Olinda district and the producer has settled to a steady production of 650 barrels. The well was completed at 5225 feet and carried a string of six and five-eighths-inch casing to bottom. The company is drilling three other wells in the field, two of which are due for completion soon.

The Richfield Oil Company succeeded in completing its Consolidated 15 in the Richfield district with a production of only 75 barrels, 40 per cent of which was water. The well was drilled to 2910 feet and an eight and one-fourth-inch liner was landed on bottom. The water showing was rather disappointing but it is possible that this condition may partially correct itself.

The Santa Fe Springs field registered a sharp slump in production during the past week, having declined nearly 2000 barrels. The drop was a natural one and was attributed to the lack of new producers and the natural decline of the old wells.

Ventura

After a series of delays, the Shell Company has completed its Gosnell 23 in the Ventura field with an initial produc-

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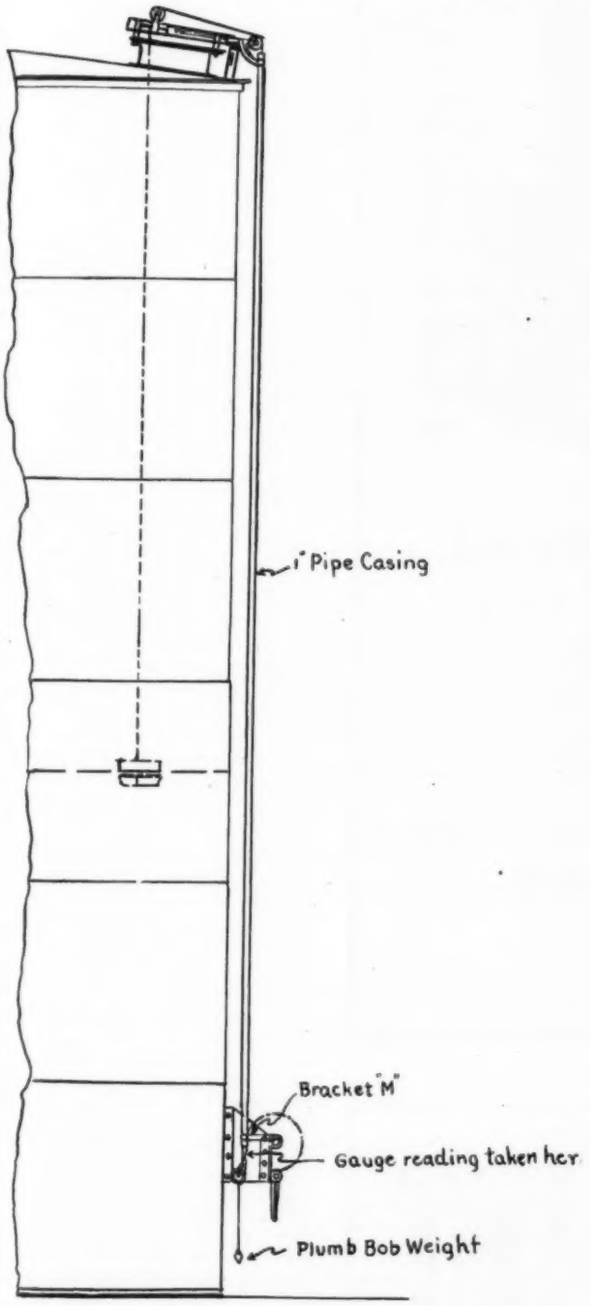

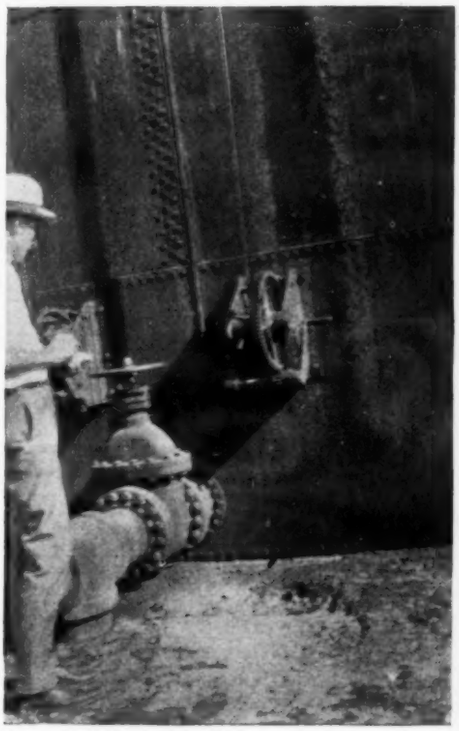

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Saved US Both Time and Money!

—The Drilling Superintendent Says: "During the severe wind storm at Pierce Junction on April 21, 1927, the Smith Tubing Head held fast the string of 3" tubing on Rio Bravo, Settegast Well B No. 4, although the derrick was blown down and both 10" and 6⅝" casings were broken off about 10 feet below the surface. The Smith Tubing Head saved us the probable loss of the entire string of tubing"!

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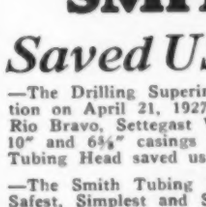

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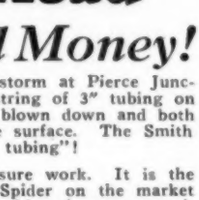

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tion of 1000 barrels. Total depth of the hole was 6315 feet, with several hundred feet of oil sand. The crude tested slightly less than 28 gravity. The Associated Oil Company has practically completed its Lloyd 44, but has been unable to make a production test. An effort will be made to bring the well in through the drill pipe at 6350 feet.

The Kern Front field continues to lead the northern group in completions. Two good producers were completed during the past week, adding to the long list of good wells finished during the past three months. The Chanslor-Canfield Midway Oil Company completed No. 6, section 23-28-27, as a 200-barrel well at 2295 feet. A six and one-fourth-inch oil string was landed on bottom and more than 300 feet of 140M screen was used. George F. Getty, one of the largest independent operators in the field, completed his Lenhart 22, section 14-28-27, with an initial production of 150 barrels. Total depth was 2090 feet. These wells, like all others in the field, will be pumped, due to the lack of gas pressure. Although a heavy, black oil producer, this field leads those in its immediate vicinity in the number of wells under way.

The Elbe Oil Company, discoverer of the Round Mountain field, near Bakersfield, has completed a third rig on the structure, but has made no announcement as to when drilling will start. The third rig is located on section 29-28-27, and the well will be known as No. 7. The discovery well is shut in, due to lack of storage and pipe line facilities. The second test, which has not yet been completed, has been plugged back from 2165 feet to 2135 feet. Water trouble has been developed but it is not thought to be in the lower sands, where the discovery well found nothing but oil.

The Miley Oil Company has failed to pick up anything of importance in its deep test in the Goleta district, where the company has considerable light oil production at a comparatively shallow depth. The deep test, Goleta 1, is drilling considerably below 4900 feet with no definite horizon in view. The shallow wells in the field yield remarkably high gravity oil but production declines very rapidly from the initial output. The present deep test leaves much doubt as to the value of the lower sands. The Miley interests are drilling nine tests in and near the field.

Water Trouble in Rincon Structure Test

Ventura, Calif. — With 700 feet of promising sand, the Chanslor-Canfield Midway Oil Company was unable to make a commercial producer of its Hobson 1B, located on the Rincon structure, near Seacliffe. The well was drilled to 4900 feet and cores taken from the hole near the bottom indicated that the well would be a good producer. A large quantity of salt water was bailed from the well during the test but there was hardly a sign of oil. The origin of the water has not been found but the encroachment probably is due to a faulty cementing job.

United States Daily Average Production

Figures below are taken from the complete revised estimates of the AMERICAN PETROLEUM INSTITUTE except for the current week, which are advance estimates issued by the A. P. I. and are subject to revision:

Month—	Oklahoma	Kansas	Texas (Outside Gulf Coast)	Gulf Coast	North Louisiana	Arkansas	Eastern States	Rocky Mountain	California	United States Ave.	Gross
January, 1926	449,370	100,130	260,180	90,290	43,990	181,190	101,000	102,300	621,300	1,946,980	60,356,380
February	450,037	101,937	245,989	91,550	45,090	169,676	99,000	98,412	605,250	1,909,637	53,469,836
March	454,762	103,300	260,262	92,712	48,787	164,312	97,625	102,325	604,500	1,929,562	59,816,422
April	467,175	101,825	263,612	88,812	50,562	169,824	100,875	106,675	600,000	1,947,387	58,421,610
May	463,750	105,690	277,700	94,550	58,150	175,430	105,700	112,300	602,720	1,995,990	61,875,690
June	456,450	107,637	302,187	89,912	60,412	167,887	106,250	112,925	606,925	2,013,187	60,395,610
July	456,920	110,320	336,600	114,760	57,460	161,870	104,700	108,520	613,940	2,062,470	63,936,570
August	465,137	111,600	381,550	161,237	56,787	157,375	108,350	110,737	609,725	2,162,662	67,042,522
September	465,387	113,037	402,212	175,512	56,575	154,037	110,125	105,825	598,100	2,180,862	65,425,860
October	497,120	114,720	439,190	170,350	58,200	149,810	109,500	99,060	611,600	2,259,850	70,055,350
November	551,225	115,425	475,987	176,425	56,575	144,100	111,125	93,537	641,325	2,365,475	70,964,250
December	561,012	118,950	483,050	181,263	55,137	139,250	110,375	87,650	659,925	2,396,112	71,279,472
January 1927	591,570	117,490	460,910	176,330	53,030	132,648	108,100	83,910	655,660	2,385,650	73,955,150
February	683,775	116,200	479,175	154,975	52,850	128,362	107,250	85,237	642,775	2,455,612	69,157,136
March	707,187	115,612	475,375	154,262	51,450	124,662	104,500	87,200	644,350	2,462,625	76,341,375
April	723,820	115,510	476,920	155,420	50,670	114,860	107,500	89,130	643,520	2,477,350	74,320,500
May	716,175	114,675	488,125	151,375	47,465	113,525	113,625	89,625	633,225	2,491,975	77,374,910
June	760,712	112,662	481,950	151,650	48,762	112,612	112,125	85,725	640,325	2,506,037	75,181,125
July	839,580	108,200	476,750	144,110	55,280	110,290	111,700	87,110	621,920	2,554,940	79,203,140
August 6	877,400	105,800	476,200	140,700	57,500	106,650	114,000	86,800	612,100	2,577,150	18,040,050
August 13	858,300	105,350	489,550	138,350	60,600	106,550	114,500	84,650	617,700	2,575,550	18,028,850
Increase	.....	.....	13,350	.....	3,100	.....	500	.....	5,600	.....	.....
Decrease	19,100	450	.....	2,350	.....	100	.....	2,150	.....	1,600	11,200

TEXAS

(Outside Gulf Coast)

PANHANDLE DISTRICT

	Aug. 13	Aug. 6
Hutchinson County	83,500	85,150
Gray County	10,400	10,200
Carson County	9,600	10,250
Wheeler County	2,050	2,250
Others	100	100
Totals	105,650	107,950

NORTH TEXAS

Burkburnett	13,550	13,650
Electra	12,900	12,950
Iowa Park-KMA	2,600	2,650
Wilbarger	13,000	13,250
Archer County	27,800	27,750
Clay County (Petrolia)	650	650
Baylor County	100	100
Montague and Cooke Counties	16,400	16,200
Totals	87,000	87,200

WEST CENTRAL TEXAS

Stephens County	9,000	8,900
Eastland-Desdemona	8,000	8,500
Brown County	24,950	25,250
Coleman County	1,000	1,050
Callahan County	3,500	3,600
Shackelford County	7,500	7,600
Young County	10,500	10,700
Throckmorton County	1,800	1,900
Jack County	600	650
Palo Pinto County	900	900
Others	650	650
Totals	68,400	69,700

WEST TEXAS

Jones County	1,900	1,950
Mitchell-Scurry Counties	4,150	4,050
Howard County	3,150	3,250
Reagan County	24,800	25,450
Crane-Upton Counties	117,400	99,200
Crockett County	1,450	1,350
Pecos County	7,550	7,350
Winkler County	2,050	1,950
Others	1,250	1,350
Totals	163,700	145,900

EAST CENTRAL TEXAS

Mexia	9,700	9,750
Currie	500	500
Richland	1,050	1,100
Wortham	3,100	3,100
Corsicana-Powell	15,200	15,450
Nigger Creek	3,000	3,050
Totals	32,550	32,950

SOUTHWEST TEXAS

Luling	17,500	17,250
Lytton Springs	2,200	2,150
Somerset	900	1,000
Laredo District	11,050	11,450
Piedras Pintas	50	50
Others	550	600
Totals	32,250	32,500
Tex. (outside Gulf Coast)	483,550	476,200

TEXAS GULF COAST

West Columbia	9,500	9,800
Damon Mound	900	900
Big Creek	2,900	3,050
Boling	1,800	1,950
Blue Ridge	3,000	3,150
Pierce Junction	6,200	6,500
Humble	3,000	3,050
Goose Creek	8,000	8,450
South Liberty	2,700	2,950
Hull	15,000	15,200
Saratoga	1,200	1,250
Batson	1,300	1,300
Sour Lake	4,300	4,250
Spindle Top	54,300	54,000
Orange County	5,100	5,250
Others	4,000	4,150
Totals	123,200	125,200
Texas Total	612,750	601,400

OKLAHOMA

North Braman	3,350	3,450
South Braman	2,500	2,750
Blackwell	3,850	3,900
Hubbard	5,050	5,250
Thomas	4,600	4,650
Tonkawa	19,350	20,300
Garber	11,450	11,550
Burbank	38,400	39,300
Osage outside Burbank)	31,300	31,350
Watchorn	1,850	1,800
Cushing	21,450	21,450
Yale Jennings	10,100	10,100
Davenport	3,000	2,950
Bristow Slick	25,500	25,600
North Okmulgee	16,550	16,600
Lyons Deaner	5,150	5,150
Stroud	1,250	1,250
Cromwell	12,350	12,400
Papoose	6,400	6,450
Wewoka	19,000	19,150
Seminole	287,650	312,100
Earlsboro	202,000	193,800
Duncan District	7,000	7,000
Graham	6,900	6,900
Fox	1,950	1,950
Healdton	14,700	14,950
Hewitt	9,900	9,950
Scholem Alechem	17,650	16,750
Others	68,150	68,600
Totals	858,300	877,400

CALIFORNIA

Santa Fe Springs	40,500	40,000
Long Beach	90,000	88,000
Huntington Beach	69,000	69,000
Torrance	21,500	21,500
Dominguez	15,500	14,000
Rosecrans	8,000	8,500
Inglewood	34,000	32,500
Midway-Sunset	86,000	89,900
Ventura Avenue	42,700	41,600
Seal Beach	55,500	55,500
Others	155,000	152,500
Totals	617,700	612,100

ARKANSAS

El Dorado	5,850	5,800
Smackover Light	10,500	10,250
Smackover Heavy	83,050	84,000
Stephens	1,300	1,350
Nevada	2,400	1,600
Lisbon	3,350	3,550
Others	100	100
Totals	106,550	106,650

KANSAS

	Aug. 13	Aug. 6
Greenwood County	34,250	34,400
Florence-Covert	1,600	1,600
Peabody-Ebling	3,850	3,850
Eldorado-Towanda	13,900	13,900
Augusta-Fox Bush	4,350	4,350
Rainbow Bend	2,250	2,200
Russell	2,350	2,600
Churchill	14,800	14,950
Others	28,000	27,950
Totals	105,350	105,800

NORTH LOUISIANA

Homer	4,900	4,900
Haynesville	7,250	7,450
Caddo Light	21,250	17,800
Caddo Heavy	5,400	5,300
DeSoto-Red River	4,050	3,950
Elm Grove	650	650
Bellevue	1,250	1,400
Cotton Valley	5,400	5,450
Urania	9,550	9,650
Pleasant Hill	900	1,050
Totals North Louisiana	60,600	57,500

LOUISIANA GULF COAST

Vinton	5,000	5,300
Lockport	5,700	5,100
Evangeline	1,000	1,100
Edgerly	2,400	2,950
Others	1,050	1,050
Total La. Gulf Coast	15,150	15,500
Total Gulf Cost	138,350	140,700

MOUNTAIN STATES

WYOMING

Salt Creek	39,750	41,400
Grass Creek	2,500	2,600
Elk Basin	1,050	1,050
Big Muddy	2,950	2,800
Lost Soldier	2,800	2,800
Rock River	2,600	2,800
Lance Creek	600	600
Teapot Dome	600	1,350
Others	5,400	5,200
Totals	58,250	60,600

MONTANA

Cat Creek	2,150	2,150
Sunburst	14,500	14,500
Others	-100	100
Totals	16,750	16,750

COLORADO

Moffats (Craig)	1,450	1,150
Fort Collins	2,700	2,950
Florence	950	1,000
Others	1,700	1,650
Totals	6,800	6,750

NEW MEXICO

Table Mesa	600	350
Artesia	1,300	1,300
Hogback	350	350
Rattelsnake	600	700
Totals	2,850	2,700
Totals, Mountain States	84,650	86,800

EASTERN STATES

(Including Ill., Ind., Ohio, W. Va., Pa., Ky., and N. Y.)	114,500	114,000

PRODUCTION SUMMARY

East of Rockies	1,873,200	1,878,250
United States	2,575,550	2,577,150

CRUDE OIL PRICE QUOTATIONS

CRUDE PRICE CHANGES

Effective August 15, Col-Tex Refining Company reduced its posted price on all crudes in the Mitchell County section of West Texas 19 cents, making the new price 93 cents.

CURRENT POSTINGS

EASTERN STATES

	Aug. 17 1927
New York Transit	2.65
Bradford District	2.65
National Transit	2.55
Southwest	2.55
Eureka	2.50
Buckeye	2.35
Macksburg	2.80
Gaines	2.60
Somerset	1.70
Cabell	1.60
Ragland	.95
Corning, 35-cent grade	1.45
Corning, 25-cent grade	1.35
Keister	1.30

CENTRAL STATES

Illinois	1.60
Indiana	1.48
Lima	1.71
Plymouth	1.33
Princeton	1.60
Waterloo	1.18
Wooster	1.57

WESTERN KENTUCKY

Posted by Stoll Refining Company for crude from Allen, Warren, Franklin, Davies, Barren, All grades 1.50

MID-CONTINENT

Prairie, Sinclair, Gulf, Texas

28 to 28.9 gravity	1.12
29 to 29.9 gravity	1.14
30 to 30.9 gravity	1.16
31 to 31.9 gravity	1.18
32 to 32.9 gravity	1.20
33 to 33.9 gravity	1.22
34 to 34.9 gravity	1.24
35 to 35.9 gravity	1.26
36 to 36.9 gravity	1.28
37 to 37.9 gravity	1.30
38 to 38.9 gravity	1.32
39 to 39.9 gravity	1.34

	Aug. 17 1927
40 to 40.9 gravity	1.36
41 to 41.9 gravity	1.38
42 to 42.9 gravity	1.40
43 to 43.9 gravity	1.42
44 to 44.9 gravity	1.44
45 to 45.9 gravity	1.48
47 to 47.9 gravity	1.50
48 to 48.9 gravity	1.52
49 to 49.9 gravity	1.54
50 to 50.9 gravity	1.56
51 to 51.9 gravity	1.58
52 and above	1.60

Magnolia Petroleum Company

Below 33	$1.05
33 to 33.9 gravity	1.07
34 to 34.9 gravity	1.09
35 to 35.9 gravity	1.11
36 to 36.9 gravity	1.13
37 to 37.9 gravity	1.15
38 to 38.9 gravity	1.17
39 to 39.9 gravity	1.19
40 to 40.9 gravity	1.21
41 to 41.9 gravity	1.23
42 to 42.9 gravity	1.25
43 to 43.9 gravity	1.27
44 to 44.9 gravity	1.29
45 to 45.9 gravity	1.31
46 to 46.9 gravity	1.33
47 to 47.9 gravity	1.35
48 to 48.9 gravity	1.37
49 to 49.9 gravity	1.39
50 to 50.9 gravity	1.41
51 to 51.9 gravity	1.43
52 and above	1.45

NORTH AND CENTRAL TEXAS

Ranger, North Texas, Mexia, Powell, Richland, Wortham, Lytton Springs, Currie, Moran and Nocona Crude

Humble O. & R. Co.* and Texas Co.

28 to 28.9 gravity	1.12
29 to 29.9 gravity	1.14
30 to 30.9 gravity	1.16
31 to 31.9 gravity	1.18
32 to 32.0 gravity	1.20
33 to 33.9 gravity	1.22
34 to 34.9 gravity	1.24
35 to 35.9 gravity	1.26
36 to 36.9 gravity	1.28
37 to 37.9 gravity	1.30
38 to 38.9 gravity	1.32
39 to 39.9 gravity	1.34

	Aug. 17 1927
40 to 40.9 gravity	1.36
41 to 41.9 gravity	1.38
42 to 42.9 gravity	1.40
43 to 43.9 gravity	1.42
44 to 44.9 gravity	1.44
45 to 45.9 gravity	1.46
46 to 46.9 gravity	1.48
47 to 47.9 gravity	1.50
48 to 48.9 gravity	1.52
49 to 49.9 gravity	1.54
50 to 50.9 gravity	1.56
51 to 51.9 gravity	1.58
52 and above	1.60

Corsicana Heavy, 1.00 per barrel, posted by Magnolia.

*Until further notice, Ranger, North Texas, Mexia, Powell, Richland, Wortham, Lytton Springs, Currie, Moran and Nocona crudes purchased at a gravity lower than 28 degrees will be paid for at the posted price for 28 degrees gravity.

SOUTH TEXAS

Mirando	1.00

SOMERSET

Grayburg

Below 33 gravity	$1.05
33 to 33.9 gravity	1.07
34 to 34.9 gravity	1.09
35 to 35.9 gravity	1.11
36 to 36.9 gravity	1.13
37 to 37.9 gravity	1.15
38 and above	1.17

GULF COAST

Grade "A" all companies	1.20
Gulf Coast Light Oil, Below 25	1.15
25 to 25.9 gravity	1.17
26 to 26.9 gravity	1.19
27 to 27.9 gravity	1.21
28 to 28.9 gravity	1.23
29 to 29.9 gravity	1.25
30 to 30.9 gravity	1.27
31 to 31.9 gravity	1.29
32 to 32.9 gravity	1.31
33 to 33.9 gravity	1.33
34 to 34.9 gravity	1.35
35 to 35.9 gravity	1.37
36 to 36.9 gravity	1.39
37 to 37.9 gravity	1.41

(Continued on page 120)

CALIFORNIA CRUDE OIL PRICES AT THE WELL

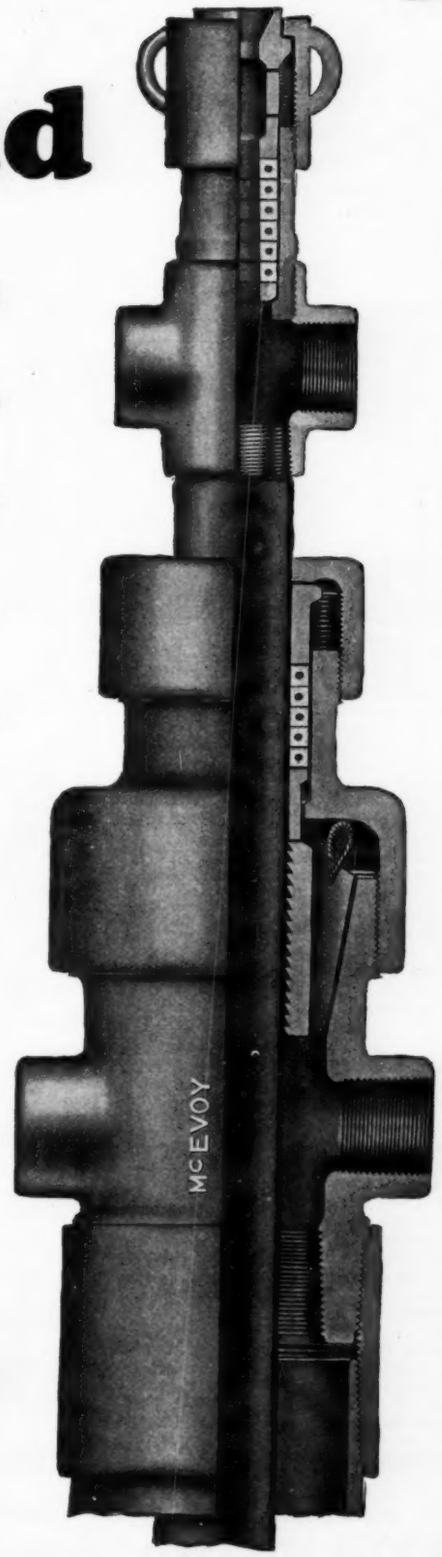
Following are the current prices offered by Standard Oil Company for crude oil at the well: (Price per barrel of 42 galolns in fields indicated)

Gravity (degrees)	Signal Hill	Seal Beach	Huntington Beach	Inglewood	Olinda-Brea Canon	Athens-Rosecrans Domingues	Torrance	Richfield	Whittier La Habra	Montebello	Coyotte Hill	Santa Fe Springs	Newhall McKittrick Kern River	Midway Sunset Elk Hills	Buena Vista Hills	Lost Hills	Coalinga	Wheeler Ridge
14-14-9	$ .85	$ .85	$ .85	$ .85	$ .85	$ ..	$ .85	$ .85	$ .85	$ .85	$ .85	$ ..	$ .75	$ .75	$ .75	$ .75	$ .75	$ .75
15-15-9	.85	.85	.85	.85	.85	..	.85	.85	.85	.85	.85	..	.75	.75	.75	.75	.75	.75
16-16-9	.85	.85	.85	.85	.85	..	.85	.85	.85	.85	.85	..	.75	.75	.75	.75	.75	.75
17-17-9	.85	.85	.85	.85	.85	..	.85	.85	.85	.85	.85	..	.75	.75	.75	.75	.75	.75
18-18-9	.85	.85	.85	.85	.85	..	.85	.85	.85	.85	.85	..	.75	.75	.75	.75	.75	.75
19-19-9	.85	.85	.85	.85	.85	..	.85	.85	.85	.85	.85	..	.75	.75	.75	.75	.75	.76
20-20-9	.85	.85	.85	.85	.85	..	.85	.85	.85	.85	.85	..	..	.77	.77	.77	.76	.77
21-21-9	.86	.86	.86	.86	.86	..	.86	.86	.85	.85	.86	.85	..	.79	.79	.79	.77	.78
22-22-9	.87	.87	.87	.87	.87	..	.87	.87	.85	.85	.87	.85	..	.81	.81	.81	.78	.79
23-23-9	.88	.88	.88	.88	.88	..	.88	.88	..	.85	.88	.85	..	.83	.83	.83	.79	.80
24-24-9	.89	.89	.89	.89	.89	..	.89	.89	..	.85	.89	.85	..	.85	.85	.85	.80	.81
25-25-9	.90	.90	.90	.90	.90	.90	.90	.90	..	.86	.90	.86	..	.87	.87	.87	.81	.82
26-26-9	.92	.92	.92	.92	.92	.92	.92	.92	..	.87	.91	.87	..	.89	.89	.89	.83	.83
27-27-9	.94	.94	.94	.94	.94	.94	.94	.94	..	.88	.92	.88	..	.91	.91	.91	.85	..
28-28-9	.96	.96	.96	.96	.96	.96	.96	.96	..	.89	.93	.89	..	.93	.93	.93	.87	..
29-29-9	.98	.98	.98	..	.98	.98	..	.98	..	.90	.94	.91	..	.96	.96	.96	.89	..
30-30-9	1.00	1.00	1.00	..	1.00	1.00	..	1.00	..	.91	.95	.93	..	.99	.99	.99	.91	..
31-31-9	1.03	1.03	1.03	..	..	1.03	..	..	..	..	..	.95	..	1.02	1.02	1.02	.93	..
32-32-9	1.06	1.06	1.06	..	..	1.06	..	..	..	..	..	.97	..	1.05	1.05	1.05	.95	..
33-33-9	..	..	..	..	..	1.09	..	..	..	..	..	.99	..	1.08	1.08	1.08	.97	..
34-34-9	..	..	..	..	..	1.12	..	..	..	..	..	1.01	..	..	..	1.11	.99	..
35-35-9	..	..	..	..	..	1.15	..	..	..	..	..	1.03	..	..	..	..	1.01	..
36-36-9	..	..	..	..	..	1.18	..	..	..	..	..	1.06	..	..	..	..	..	..
37-37-9	..	..	..	..	..	1.21	..	..	..	..	..	1.09	..	..	..	..	..	..
38-38-9	..	..	..	..	..	1.24	..	..	..	..	..	1.12	..	..	..	..	..	..
39-39-9	..	..	..	..	..	1.27	..	..	..	..	..	1.15	..	..	..	..	..	..
40-40-9	..	..	..	..	..	1.30	..	..	..	..	..	..	..	..	..	..	..	..
41-41-9	..	..	..	..	..	1.33	..	..	..	..	..	..	..	..	..	..	..	..
42-42-9	..	..	..	..	..	1.36	..	..	..	..	..	..	..	..	..	..	..	..

McEvoy Universal Casing *and* Tubing Head

1. A compact unit developed to handle production in all its phases during the life of the well.
2. **Designed for production by natural flow, air or gas lift, or by pumping.**
3. Saving in oil, and conservation of gas, pays for installation.
4. Suspension of tubing by slips or head at any point, for any purpose, easily accomplished.
5. Tested to meet all pressures encountered in wells, and to support all load thrusts of tubing.

Write for full description, advantages and prices



McEvoy Casing and Tubing Head Complete
Patent Pending

McEVOY PRODUCTS.

McEvoy Wireless Well Strainers.
McEvoy Set Shoe Assemblies.
McEvoy Upset End Flush Joint Bailers.
Packers, Back Pressure Valves, Wash Plugs, Wash Rings, Oil, Gas and Water Well Supplies.

J. H. McEvoy & Co.
Houston, Texas

Pacific Representative

McEVOY SCREEN PIPE CO.
2428 E. 56th St.
Los Angeles, Calif.

	Aug. 17 1927
38 to 38.9 gravity	1.43
39 to 39.9 gravity	1.45
40 and above	1.47

*Humble Oil & Refining Company's postings on Gulf Coast Light stop at 35 to 35.9. Its price on all crudes above 35 is $1.37 per barrel.

Magnolia Petroleum Company's postings stop at 31 to 31.9.

MARKHAM
The Texas Company

All grades	1.00

LULING

All grades	1.00

TEXAS PANHANDLE
Magnolia Petroleum Company

Hutchinson, Carson and Gray counties, all grades	.95
Humble Oil & Refining Company, Gulf Refining Company and Kay County Gas Company, all grades	.95

Gray and Wheeler Counties
Humble Oil & Refining Company

28 to 28.9 gravity	.80
29 to 29.9 gravity	.82
30 to 30.9 gravity	.84
31 to 31.9 gravity	.86
32 to 32.9 gravity	.88
33 to 33.9 gravity	.90
34 to 34.9 gravity	.92
35 to 35.9 gravity	.94
36 to 36.9 gravity	.96
37 to 37.9 gravity	.98
38 to 38.9 gravity	1.00
39 to 39.9 gravity	1.02
40 to 40.9 gravity	1.04
41 to 41.9 gravity	1.06
42 to 42.9 gravity	1.08
43 to 43.9 gravity	1.10
44 and above	1.12

Crane-Upton-Crockett* Counties
Gulf, Humble and Kay County Gas Company

Below 26 gravity	.70
26 to 26.9 gravity	.72
27 to 27.9 gravity	.74
28 to 28.9 gravity	.76
29 to 29.9 gravity	.78
30 to 30.9 gravity	.80
31 to 31.9 gravity	.82
32 to 32.9 gravity	.84
33 to 33.9 gravity	.86
34 to 34.9 gravity	.88
35 to 35.9 gravity	.90
36 and above	.92

*Gulf does not post in Crockett County.

Magnolia Petroleum Company and Kay County Gas Company

Howard County (Chalk Field)	1.05

Col-Tex Refining Company

Mitchell County	$ .93

WYOMING-MONTANA
Wyoming

Byron	1.33
Ferris	1.60
Elk Basin	133
Grass Creek	1.33
Rock Creek	1.25
Lost Soldier	.95
Lance Creek	1.33
Mule Creek	1.10
Notches	.65
Big Muddy	1.25
Osage	1.33
Hamilton Dome	.85
Pilot Butte	1.75
Torchlight-Greybull	1.55
Lander	.80
Simpson Ridge	.80
Rex Lake	1.10
South Casper Creek-Poison Spider	1.00

Salt Creek
Midwest Refining Company

29 to 29.9 gravity	1.14
30 to 30.9 gravity	1.16
31 to 31.9 gravity	1.18
32 to 32.9 gravity	1.20
33 to 33.9 gravity	1.22
34 to 34.9 gravity	1.24
35 to 35.9 gravity	1.26
36 to 36.9 gravity	1.28
37 and above	1.30

MONTANA

	Aug. 17 1927
Sunburst	1.35
Cat Creek	1.33
Lake Basin	2.20

NEW MEXICO

Artesia	1.00
Hogback	1.38

CANADIAN CRUDE

Oil Springs	2.18
Petrolia	2.11

*Bounty on Canadian crude is ¾ cent per gallon, or 26¼ cents per barrel.

LOUISIANA-ARKANSAS
(Standard of Louisiana, Louisiana Oil Refining Company, Gulf Refining Company of Louisiana and The Texas Co.) Homer, Haynesville, Caddo, El Dorado, De Soto and Chrichton.

Below 28 gravity	1.10
28 to 28.9 gravity	1.12
29 to 29.9 gravity	1.14
30 to 30.9 gravity	1.16
31 to 31.9 gravity	1.18
32 to 32.9 gravity	1.20
33 to 33.9 gravity	1.22
34 to 34.9 gravity	1.24
35 to 35.9 gravity	1.26
36 to 36.9 gravity	1.28
37 to 37.9 gravity	1.30
38 to 38.9 gravity	1.32
39 to 39.9 gravity	1.34
40 to 40.9 gravity	1.36
41 to 41.9 gravity	1.38
42 to 42.9 gravity	1.40
43 to 43.9 gravity	1.42
44 to 44.9 gravity	1.44
45 to 45.9 gravity	1.46

	Aug. 17 1927
46 to 46.9 gravity	1.48
47 to 47.9 gravity	1.50
48 to 48.9 gravity	1.52
49 to 49.9 gravity	1.54
50 to 50.9 gravity	1.56
51 to 51.9 gravity	1.58
52 and above	1.60

Atlantic Oil Producing Company posts this same schedule on Homer, Haynesville, and West El Dorado.

Magnolia Petroleum Company has the same posting on Pine Island, Haynesville, Eldorado and Bull Bayou.

STEPHENS
(All Companies)

Below 28	1.00
28 to 28.9 gravity	1.04
29 to 29.9 gravity	1.04
30 to 30.9 gravity	1.06
31 to 31.9 gravity	1.08
32 and above	1.10

SMACKOVER
(All Companies)

Below 24 gravity	$1.00
24 and above	1.25

Bellevue	1.25
Jennings	1.15
Vinton	1.30
Edgerly	1.30
Starks Dome	1.30
Urania	1.00
Cotton Valley	1.00
Calion	1.00

IMPORTS OF PETROLEUM AT PRINCIPAL UNITED STATES PORTS
American Petroleum Institute Figures. Barrels of 42 gallons)

AT ATLANTIC COAST PORTS—	Total Month July	Total Month June	Week En'd Aug. 6	Week En'd July 30
Baltimore	689,000	545,000	100,000	265,000
Boston	322,000	*359,000	65,000	65,000
New York	2,486,000	2,516,000	577,000	733,000
Philadelphia	223,000	327,000	66,000	.....
Others	1,200,000	497,000	311,000	287,000
Total	4,920,000	*4,244,000	1,119,000	1,350,000
Daily average	158,710	* 141,467	159,857	192,857
AT GULF COAST PORTS—				
Galveston District	100,000	60,000	.....	.....
New Orleans and Baton Rouge	777,000	954,000	263,000	144,000
Port Arthur and Sabine District	25,000	.....	.....	.....
Tampa	.....	.....	.....	.....
Total	902,000	1,014,000	263,000	144,000
Daily average	29,096	33,800	37,572	20,571
AT ALL UNITED STATES PORTS—				
Total	5,822,000	*5,258,000	1,382,000	1,494,000
Daily average	187,806	175,267	197,429	213,428

*Revised.

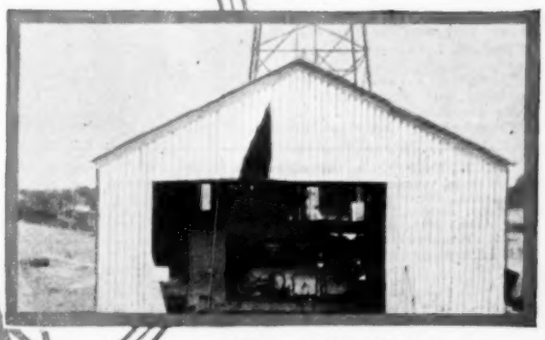
RECEIPTS OF CALIFORNIA OIL AT ATLANTIC AND GULF COAST PORTS
American Petroleum Institute Figures. Barrels of 42 gallons)

AT ATLANTIC COAST PORTS—	Total Month July	Total Month June	Week En'd Aug. 6	Week En'd July 30
Baltimore	418,000	767,000	198,000	143,000
Boston	536,000	337,000	.....	70,000
New York	1,025,000	1,465,000	296,000	.....
Philadelphia	283,000	521,000	.....	60,000
Others	169,000	521,000	79,000	109,000
Total	2,431,000	3,611,000	573,000	382,000
Daily average	78,419	120,367	81,857	54,571
AT GULF COAST PORTS—				
	30,000	.....	.....	.....
Daily Average	968	.....	.....	.....
Total Atlantic and Gulf Coast Ports	2,461,000	3,611,000	573,000	382,000
Daily average	79,387	120,367	81,857	54,571
DISTRIBUTION OF TOTAL CALIFORNIA OIL RECEIPTS IS AS FOLLOWS:				
Crude	*903,000	*1,605,000	341,000	.....
Gasoline	*1,001,000	*1,260,000	158,000	258,000
Gas Oil	293,000	* 78,000	74,000	65,000
Fuel Oil	264,000	610,000	.....	59,000
Lubricants	.....	58,000	.....	.....
Total	2,461,000	3,611,000	573,000	382,000

*Revised.

Climax Drilling Engine and Clutch being moved by truck to location for Dyer Bros., Guthrie, King Co., Texas.

When Hours Count



Climax Drilling Engines on location, operated by Garden Drilling Co., Guthrie, Texas.

You Can Count on

CLIMAX

Trade Mark Reg. U. S. Pat. Off.

DRILLING UNITS

Many a lease has been saved by the easy portability, quick set-up, fueling convenience, small water requirement, and the exceptional drilling speed of these remarkable Units.

—Easily moved by truck at small expense.
—No concrete foundation required.
—Ready to go at a touch of the starter button.
—Operate on gasoline or natural gas.
—Use less than ½ bbl. of water in 24 hours.
—Give ideal drilling motion.
—Handle any size string of tools.
—Stall when tools stick—same as steam.

Write for Bulletin H, reports of actual field performance and list of users

CLIMAX ENGINEERING CO., Clinton, Iowa

Exclusive Foreign Oil Field Distributors:

THE NATIONAL SUPPLY CORPORATION

120 Broadway, New York, N. Y.

165 Queen Victoria St., London, E. C. 4, England

DISTRIBUTED BY

THE NATIONAL SUPPLY COMPANIES

NSCO

COMPLETIONS FOR PAST WEEK IN U.S. FIELDS

SUMMARIZED REVIEW OF FIELD RESULTS

State—	Completions This Week	Completions Last Week	Producers This Week	Producers Last Week	Gas Wells This Week	Gas Wells Last Week	Failures This Week	Failures Last Week	Initial Production This Week	Initial Production Last Week
Arkansas	9	7	3	6	2	..	4	1	565	685
California	13	12	13	11	..	..	..	1	7,490	6,305
Indiana	6	9	4	4	..	..	2	5	455	180
Illinois	5	7	2	4	..	..	3	3	82	88
Kansas	..	15	..	5	..	2	..	8	...	925
Kentucky	30	21	20	13	..	2	10	6	1,118	531
Louisiana	19	14	8	7	4	2	7	5	2,405	1,355
Michigan	8	..	7	..	..	..	1	..	102	...
Montana	11	5	6	3	5	..	..	2	1,650	1,220
New Mexico	2	..	2	..	..	..	..	..	60	...
New York	19	..	17	..	1	..	1	..	118	...
Ohio	38	39	17	24	15	10	6	5	447	268
Oklahoma	..	77	..	37	..	12	..	28	...	55,521
Pennsylvania	80	..	64	..	12	..	4	..	433	...
Tennessee	2	..	2	..	..	..	..	..	150	...
Texas	109	116	50	65	10	6	49	45	48,180	18,626
West Virginia	17	23	5	5	10	15	2	3	189	60
Wyoming	1	3	..	3	1	..	..	..	...	2,306
*Totals	369	348	220	187	60	49	89	112	63,444	88,070
Increase this week	21	..	33	..	11	..	..	..	...	...
Decrease this week	..	..	..	..	..	..	23	..	24,626	...

*Figures for this week do not include Kansas and Oklahoma.

NOTE—Following is the explanation of abbreviations, signs, etc., used in completion and wildcat reports: *—dry hole, abandoned well; ‡—salt water; †—junked and abandoned; ¶—million cubic feet of gas; abn—abandoned; bbls—barrels; b. s.—basic sediment; cas—casing; co—cleaning out; dk—derrick; dr—drilling; fsh—fishing; ft—feet; in—inches; lcn—location; m—milling; n, s, e, w—north, south, east, west; r—reaming; sd—shut down; sdtr—sidetracking; sp—spudding; sr—straight reaming; std—standardizing; sw—salt water; td—total depth; ur—underreaming; wo—workover; wosr—waiting on standard rig.

EASTERN STATES

PENNSYLVANIA

Company, Well and Location	Initial Production Bbls.	Depth
BRADFORD FIELD—		
South Penn Oil Co., Fee 35	4	....
Fee 112	3	....
Bingham 150, tr 84	4	....
Bingham 501, tr 18	10	....
Bingham 400, tr 83	3	....
Bingham 88, tr 13	2	....
Bingham 395, tr 1	3	....
Bingham 450, tr 92	2	....
Melvin 193	2	....
Melvin 194	2	....
Cotton 61	2	....
Cotton 62	2	....
Lots 5 and 6, tract 41	2	....
Lots 5 and 6, tract 42	2	....
Jackson 18	2	....
Jones 231	2	....
Forest Pet. Corp., Drake 1-G49	115	....
Drake 1-G57	15	....
Drake 1-G55	12	....
Drake 1-G41	12	....
Drake 1-G32	10	....
Drake 1-G14	10	....
Drake 1-G52	10	....
Drake 178	7	....
Drake 179	3	....
Taylor 1-D13	5	....
Taylor 1-C9	4	....
Taylor 1-E12	3	....
Taylor 1-E18	3	....
Simms 1-B24	5	....
Simms 1-B29	7	....
Simms 1-A39	10	....
Fischer 71	4	....
Forest Oil Corp., Fee 1	2	....
Tyler 2	18	....
Hazlewood Oil Co., Hazlewood 8	2	....
Bingham 134, tr 134	4	....
Black 21, tr 76	2	....
Associated Producrs Co., Bingham 582, tr 382	7	....
Phoenix Oil Co., Kennedy-Clark 170	20	....
Penbrook Oil Co., Franchot 20	4	....
J. W. Kaufman, Rounds 6	10	....
Mix Creek Oil Co., Mix Creek 36	5	....
Piper & Lloyd, Ekas 37	2	....
Dunlavey Bros. & Curtis, Fee 2	7	....
Dunlavey Bros. & Curtis, Fee 3	4	....
D. J. Moody, Moody 10	4	....
T. P. Thompson, Franchot 14	3	....
T. H. Kennedy, Kennedy 35	3	....
Petroleum Reclamation Co., Fee 124	¶½	....
F. E. Baldwin, Baldwin 6	3	....
A. H. Wiborg, Meldrum 4	4	....
Kendall Ref. Co., Bishop 4	2	....
Penna. Oil Products Ref. Co., Fee 5	3	....
GREENE COUNTY—		
Carnegie Nat. Gas Co., Scott 1	¶2¼	....
Fox 1	¶2	....
Peoples Nat. Gas Co., Leviaengood 1	¶1	....
Lynch 2	¶1	....
Philadelphia Gas Co., Thorp 1	¶4¾	....
Dun Car O. & G. Co., Null 1	¶2½	....
Jesse L. Garard, Longanecker 4	¶2	780
VENANGO COUNTY—		
Plum O. & G. Co., Hasson 1	3	....
Hasson 2	3	....
Morgan & Hughes, Hughes 3	2	....
Hughes 4	4	....
Humphrey & Co., Riddle 1	¶1	....
E. A. Bream & Co., Hunter 10	3	....
BUTLER COUNTY—		
M. W. Graham & Co., Campbell 9	4	....
Dow Smith & Co., Smith 2	2	....
George Levier, Levier 1	¶1¼	....
E. Boyle & Co., Ewentier 1	*	....
Chambers Oil Co., Wicks Estate 19	*	....
CLARION COUNTY—		
J. W. Knoppenberger, Knoppenberger 4	3	....
John Wedekind, Wedekind 1	¶1	....
Alum Rock Gas Co., Daum 2	¶1	....
Beary & Co., Moran 4	¶1	....
Elder & Hall, Bowser 1	*	....
CENTER-MIDDLE FIELD—		
Rembold & Co., Osgood 16	12	....
Hawkey & Byers, Shanley 21	*	....
F. Keller & Co., Foster 8	2	....

NEW YORK

Company, Well and Location	Initial Production Bbls.	Depth
ALLEGANY COUNTY—		
Forest Oil Corp., Fee 337	55	....
Fee 335	7	....
Fee 318	4	....
Fee 6	3	....
Fee 29	5	....
McKean Nat. Gas Co., Lamphere 4	¶½	....
Fee 4	3	....
N. V. V. Franchot, Trus., Fries 6	4	....
Meridian & Co., 4	4	....
J. E. Miller & Co., Miller 4	2	....
Miller 5	2	....
Hazlewood Oil Co., Hazlewood 63	7	....
S. J. Cleveland, Cleveland 1	5	....
E. G. Williams, Williams 3	5	....
Stebbins & Atwood, Haseltine 2	*	....
M. J. Crowley & Co., Coast & Co. 7	4	....
F. J. Wilson, Coss 1	3	....
E. G. Maloney, Maloney 1	2	....
O. W. & L. Perry, Perry 3	3	....

WEST VIRGINIA

Company, Well and Location	Initial Production Bbls.	Depth
CALHOUN COUNTY—		
Hope Nat. Gas Co., King 1	¶2	....
Valley Gas Co., Osborne 1	2	....
Godfrey L. Cabot, Garrettson 2	¶1½	....
RITCHIE COUNTY—		
South Penn Oil Co., Anna M. Wilson 7	160	....
Astron Oil Co., Stursburg 6	12	....
PUTNAM COUNTY—		
Dalton & Franklin, Gibson 1	¶1	....
Gibson 2	¶2	....
LINCOLN COUNTY—		
Transylvania Ref. Co., Diaz 1	¶1	....
L. R. Sweetland, Sweetland 19	¶1	....
GILMER COUNTY—		
South Penn Oil Co., Ellison 1	*	....
Charles Despard, Wright 1	¶1¼	....
CLAY COUNTY—		
South Penn Oil Co., Hicks 6	10	....
ROANE COUNTY—		
Godfrey L. Cabot, Perot 1	5	....
KANAWHA COUNTY—		
United Fuel Gas Co., Patterson 746	¶2	....
MARION COUNTY—		
Owens Bottle Machine Co., Rosamine 1	¶1¾	....
BOONE COUNTY—		
United Fuel Gas Co., Horse Creek Coal & Land 1	¶¼	....
WIRT COUNTY—		
Roberts Oil Co., Rex 5	*	....

KENTUCKY

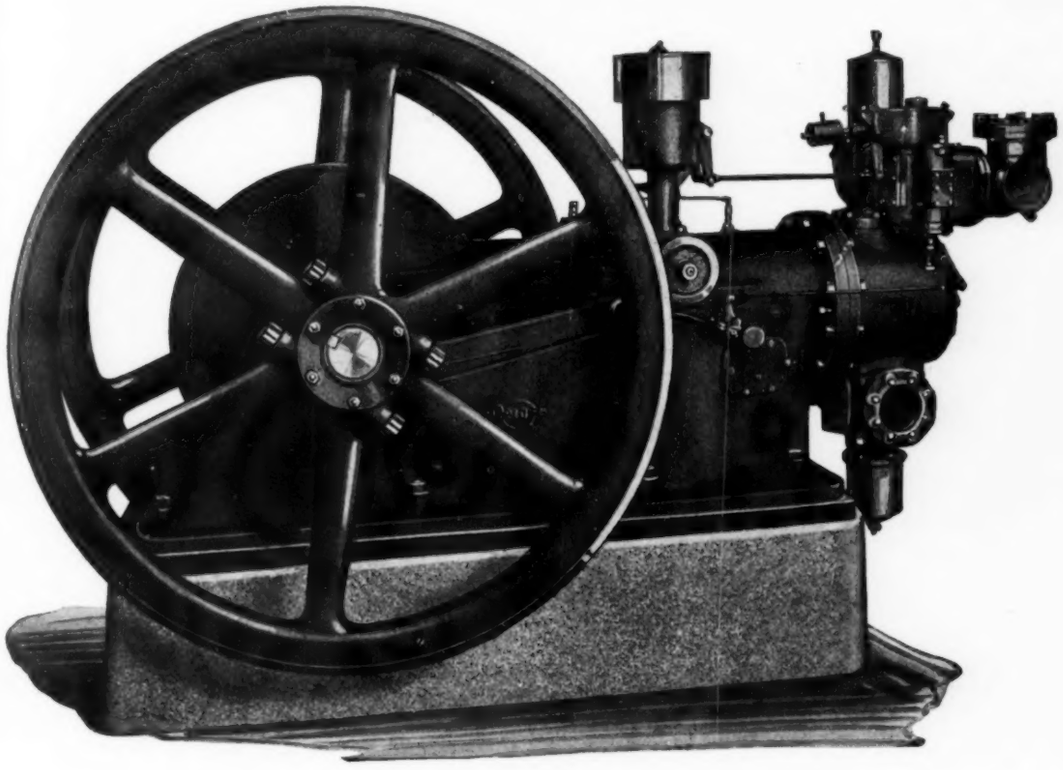
Company, Well and Location	Initial Production Bbls.	Depth
WAYNE COUNTY—		
W. O. Souther, Jr., Jones 7	3	....
Somerset Oil Co., Coffee 2	*	....
ESTILL COUNTY—		
Superior Oil Corp., Miller 6	*	....
Alexander 17	*	....
Mt. Springs Oil Co., Rogers 15	3	....
Wood Oil Co., Neal 3	2	....
Adma Oil Co., Stewart 14	2	....
POWELL COUNTY—		
Dunham & Co., Rogers 6	3	....
JOHNSON-MAGOFFIN COUNTIES—		
Reno Oil Co., Conley 8	4	....
Phillips, Young & Co., Bracken Hrs. 4	5	....
ELLIOTT COUNTY—		
Edra Lee O. & G. Co., Wheeler 2	*	....
McCREARY COUNTY—		
McCreary County Oil Co., Pleasant Run 1	*	....
WARREN COUNTY—		
S. E. Silverthorn, McGinnis 4	60	470
DAVIESS COUNTY—		
Leeper Oil Co., Robey 5	40	....
OHIO COUNTY—		
The Ohio Oil Co., Taylor 9	150	670
Taylor 10	2	663
Ellis 8	143	655
Gray 1	150	678
Wood Oil Co., Elmore 11	200	672
James C. Ellis, Weller 24	100	631
Creek Drilling Co., Early 8	225	626
Lake 3	*	973
Buckner & Co., Owen 2	10	769
Chicago Pet. Synd., Crowe 5	10	769
H. A. Henry, Chambers 6	5	....
Rex-Pyramid Oil Co., Ford 2	*	915
L. C. Young, Welles 1	*	....
F. D. Stone, Barker 1	*	....
W. P. Evans & Co., St. Clair 1	*	....

TENNESSEE

Company, Well and Location	Initial Production Bbls.	Depth
JACKSON COUNTY—		
Celina Oil Co., Hawkins 6	50	....
Hawkins 7	100	....

SOUTHEASTERN OHIO

Company, Well and Location	Initial Production Bbls.	Depth
WASHINGTON COUNTY—		
Hill Top O. & G. Co., Barnett 6	5	....
John W. Dotson & Co., Freidak 1	2	....
First Nat. Bank of Marietta, Herlan-Mendenhall 38	2	....
Charles L. Erb & Co., Epler 1	*	....



Reid Four Cycle Engines

45 HP Rated Speed—175 RPM

65 HP Rated Speed—150 RPM

JOSEPH REID GAS ENGINE COMPANY
OIL CITY, PENNSYLVANIA, U. S. A.

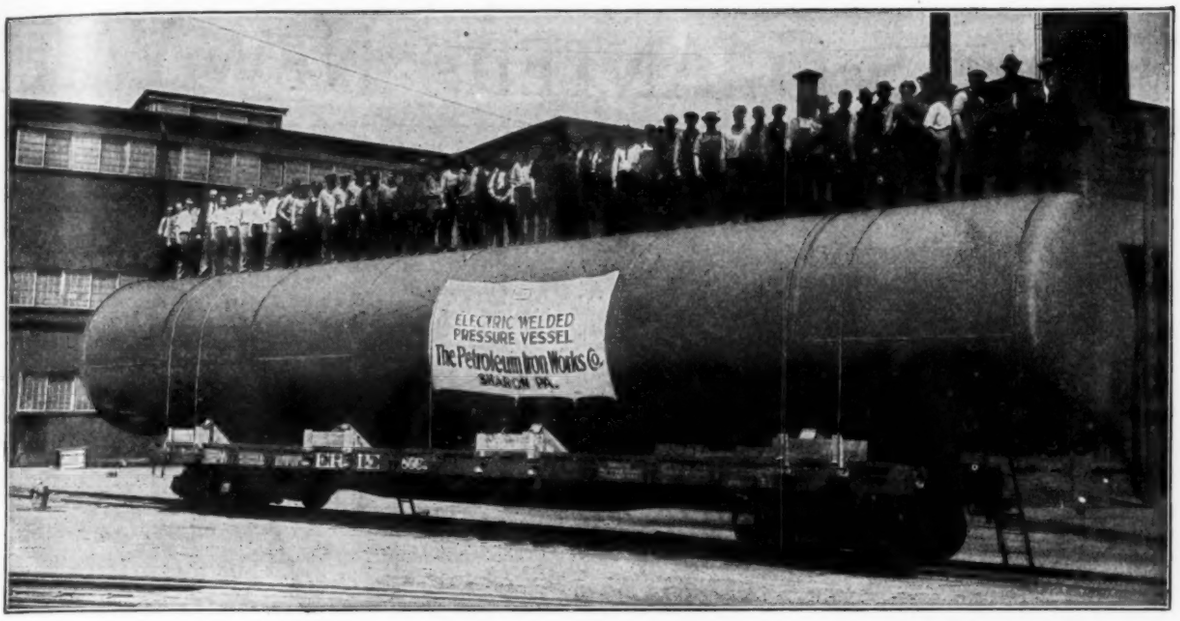
BRANCHES AND AGENCIES—Marietta, Ohio; Logan, Ohio; Newark, Ohio; Shreveport, La.; Charleston, W. Va.; R. B. Moore, Bolivar, N. Y.; Frick & Lindsay Co., Bradford, Penna., and Kentucky Distributors; S. R. Shoup, 724 Board of Trade Bldg., Los Angeles, Cal; Frick-Reid Supply Company, Tulsa, Oklahoma, and Branches, Distributors for Oklahoma, Kansas, Texas, Arkansas and Wyoming. Branch Shop, Tulsa, Oklahoma.

EXPORT SALES REPRESENTATIVE: Oil Field Equipment Co., Inc., 30 Church St., New York City.

REID OIL FIELD MACHINERY

Company, Well and Location	Initial Production Bbls.	Depth
JEFFERSON COUNTY—		
S. H. Boyce & Co., Groves 13	6	
BELMONT COUNTY—		
Natural Gas Co. of West Va., Clark 1	¶1	
CENTRAL OHIO		
HOLMES COUNTY—		
East Ohio Gas Co., Anderson 5	90	
Baker 7	20	
Pure Oil Co., Kendall 3	5	
Empire Gas & Fuel Co., Bucklew 1	*	
PERRY COUNTY—		
Dave L. Melick, Trus., Cannon Bros. 1	105	
ASHLAND COUNTY—		
Ohio Fuel Gas Co., Siddle 1	¶¼	
Logan Gas Co., Brown 2	¶2	
Paxton 1	¶3½	
S. S. Hulse, Ferguson 1	¶2	
MEDINA COUNTY—		
Logan Gas Co., Metzger 1	*	
Ohio Fuel Gas Co., Shaw 1	*	
Hawk & Co., Widdowson 1	¶1	
M. C. & G. H. Rogers, Snyder 1	¶1¼	
COSHOCTON COUNTY—		
Empire Gas & Fuel Co., Parks 1	¶2	
East Ohio Gas Co., Nyhart 2	¶3	
Ohio Fuel Gas Co., Miller 1	¶2	
GUERNSEY COUNTY—		
Davis Bros. & Co., Ruby 3	100	
Pure Oil Co., White Sisters 4	30	
LICKING COUNTY—		
Hope Construction & Ref. Co., Coomes 1	10	3199
Wehrle Interests, Smith 7	5	
MEIGS COUNTY—		
Ohio Fuel Supply Co., Easterday 4	5	
Coal Hollow O&G Co., Burdette 1	2	
KNOX COUNTY—		
Bell Bros., Clark 1	¶¼	954
East Ohio Gas Co., Staats 1	*	
MUSKINGUM COUNTY—		
J. J. Keller & Co., Boyce 5	5	
WAYNE COUNTY—		
Glen Harmon & Co., McFadden 1	¶2¾	
CUYAHOGA COUNTY—		
Hulse & Kundtz, Barnum 2	¶1¾	
LORAIN COUNTY—		
Ohio Fuel Gas Co., Weitzel 1	¶¾	
NORTHWESTERN OHIO		
AUGLAIZE COUNTY—		
Brookside O&G Co., Knuckerman 5	45	1227
SANDUSKY COUNTY—		
Frank Haubert & Co., Havens 2	10	1328
PAULDING COUNTY—		
Thomas Kneer & Co., Henry 1	¶2	
OTTAWA COUNTY—		
The Ohio Oil Co., Block 1	*	
INDIANA		
GIBSON COUNTY—		
J. S. Young & Co., Jenkins 2	200	1413
Hollingsworth 4	125	1430
Mann & Huber, Hutchison 2	125	1416
DAVIESS COUNTY—		
Home Oil Co., Nat. City Bank Land 2	5	1100
Cavinal & Co., Allison 3	*	1400
PIKE COUNTY—		
Bell Bros., Ropp 1	*	1180
ILLINOIS		
WABASH COUNTY—		
H. R. Martin & Co., Gher 2	80	1356
Keneipp & Co., Buchannan 1	*	1630
Mayhugh & Co., Kogan Hrs. 14	*	1585
CUMBERLAND COUNTY—		
Cumberland Oil Co., Roberts 1	2	680
E. A. Ruedy & Co., Robey 1	*	690
MICHIGAN		
SAGINAW COUNTY—		
Sagniaw Prospecting Co., Brechtelsbauer 5	15	1839
Eddy Estate 3	20	1816
Sun Oil Co., Kuck 2	10	1857
J. & S. Dev. Co., Sliva 1	10	1867
Myron E. Lee, Brechtelsbauer 4	12	1820
Charles A. Schwartz, McColgan 1	20	1827
V. M. Vorhees & Co., Beeker 1	15	1820
Michigan Pet. Co., Rogner 1	*	3010
ARKANSAS		
NEVADA COUNTY—		
Autrey Oil Co., Martin B-1, 6-14-20	¶5	1169
Zingg et al, Moss A-2, 12-14-21	125	1169
OUACHITA COUNTY—		
Marine Oil Co., Snyder 10-A, 34-15-15	240	2364
UNION COUNTY—		
Gulf, Berry 11, 8-16-15	¶17	2630
E. M. Jones, Murphy 10, 17-16-15	200	2528
LOUISIANA		
CADDO PARISH—		
J. R. Bahan, Stringfellow 3, 19-17-16	¶1½	2813
Magnolia, Bryson 2, 8-17-16	¶3½	961
The Texas Company, Noel B-13, 14-21-15	390	3803
DE SOTO PARISH—		
Seip et al, Robertson 1, 18-10-12	18	3194
LA SALLE PARISH—		
Sackrider Tr.'s State 1, 26-10-1e	75	1502
Tunica Pet. Co. Whatley 1, 9-7-2e	2	830
OUACHITA PARISH—		
Louisiana Dev. Co., Fee 42, 31-20-5e	¶9	2193
UNION PARISH—		
Southern Carbon Co., Gully 1, 19-20-4e	¶8½	2149
SOUTH LOUISIANA		
EDGERLY—		
Rex Pet. Co., Hunter 6	255	3550
LOCKPORT—		
Vacuum-Gulf, Miller 6	135	4450
Miller 16	1500	5100
TEXAS		
GULF COAST		
SPINDLE TOP—		
Texas Co., Garrick 1	*	5900
BATSON—		
Sun Co., Paraffine 76	25	1175
HULL—		
Gulf, Phoenix 10	*	3250
Phoenix 73	*	4600
Republic, Dolbear 102	60	2125
BIG CREEK—		
Gulf, Davis 24	590	**2900**
Texas Co., Fee 4	30	3900
ORANGE—		
Gulf, Granger et al 4	*	5000
EAST TEXAS		
HARRISON COUNTY—		
Ferguson et al, Abney 3, J. J. Blair sur	¶4	962
State Line O. & G. Co., Abney 3, J. J. Blair sur	¶8	1922
TEXAS PANHANDLE		
GRAY COUNTY—		
Atlantic Oil Prod. Co. et al, Coombs-Worley 1-D, shot	165	3152
Prairie O. & G. Co. et al, Coomley 1	500	3195
HUTCHINSON COUNTY—		
Marland, Carver 1	¶5	3960
Red Hill Pet. Corp., Johnson-Deal 1	¶40	2635
The Texas Co., E. Cockrell 2	700	2886
WHEELER COUNTY—		
Angus et al, Morgan 1	¶24	1926
WEST TEXAS		
BIG LAKE		
Big Lake Oil Co., University 118	140	3001
CRANE COUNTY		
Gulf, McElroy 21, shot	2040	2924
McElroy 22, shot	1920	2929
McElroy 24, shot	1440	2859
Landreth Prod. Corp., State-Strip 10, shot	270	3008
State-Strip 11	8110	2840
Magnolia, University-Hardwick 7, shot	670	2991
University-Hardwick 8, shot	45	3093
Simms Oil Co. & Atlantic Oil Prod. Co., University 3-D, shot	800	3002
University 6-D, shot	810	2971
CROCKETT COUNTY		
Humble & Marland, Powell 2-B, shot	45	2686
PECOS COUNTY		
The California Co., Yates 1	6000	1027
McMan O. & G. Co. and Marland, Yates 1	6500	1315
Mid-Kansas & Transcontinental, Yates 5-A	2900	1316
UPTON COUNTY		
Dixie, Burleson 28	200	2030
Gulf, Lane 3	80	2019
Texas Pacific Coal & Oil Co., Lane 10-A	200	2093
The Texas Co., J. M. Perry 2	2500	1961
WINKLER COUNTY		
Pure, Grisham-Hunter 1	5000	2838
NORTH TEXAS		
ARCHER COUNTY		
Bridwell-Heydrick Oil Co., Perkins 2	*	1765
Harrell & Allen, Dunnam 1	*	1502
Panhandle Ref. Co., Prideaux 2-C	5	657
Abercrombie-Taylor 1	*	1430
Plains Prod. Co., Wilson 2	*	1600
J. P. Rayzor et al, Key 1	*	1450
Royal Pet. Co., Wilson 15	115	1538
Sun, Harris 1	*	1400
CLAY COUNTY		
Lone Star Gas Co., Stine 19	*	1801
COOKE COUNTY		
American Ref. Co., Dennis 7	20	1720
Danciger O. & R. Co., Harris 1-B	*	2121
Magnolia, C. E. Stacey 1	*	2010
J. W. Andress 1	¶1½	1185
Oil Operators Trust, Kleiss 7	125	1598
DENTON COUNTY		
Kelsey & Chancellor, Trietsch 1	*	1840
Rondeau et al, Hughes 1	*	1316
ELECTRA		
Lanning-Chenault et al, McCarty 1	25	1346
JACK COUNTY		
Buttram Pet. Corp., Cullers & Sporer 1	45	2087
Lamar et al, Moore 1	*	704
Nash-Windfohr et al, Jones 1	60	2054
K-M-A AND IOWA PARK		
Bailey-Damuth Drilling Co., Lewis 1	*	1777
Bridwell-Mayfield, Throckmorton 1	*	1985
T. F. Hunter et al, Fassett 1	*	2001
Turner et al, Hodge 1	*	1856
MONTAGUE COUNTY		
Humble, Cunningham 1	*	1800
SOUTH VERNON DISTRICT		
Anderson et al, Waggoner 1	*	2500
Waggoner Ref. Co., Waggoner 1-C	85	2337
YOUNG COUNTY		
Anderson & Hamilton, Jones 1	*	928
Carter & Allday Oil Co., Campbell 1	*	1005
Conner et al, McCluskey 9	*	2630
Donohoe & Johnson, Eichenberger 1	*	1103
P. F. Gwynn, Boyd & Roxana, McCluer 1-A	*	1106
Harrell et al, Routon 1	*	905
Minnich et al, Alexander 1	*	1225
J. J. Moran et al, Gragg 2	45	765
Trancontinental Oil Co., C. P. Moore 1	*	4737
C. C. Williams et al, Casey 1	*	580
MEXIA-CORSICANA DISTRICT		
MEXIA		
Magnolia, Thompson 13-B	20	3167
Thompson 6-A	10	3130
CENTRAL WEST TEXAS		
BROWN COUNTY		
Cranfill-Reynolds Oil Co., Smith 1	325	1338
Forrest Oil Co., Smith 7	1500	1342
Phillips, Hickman 8	20	1253
Selby O. & G. Co., Ellis 5	150	1341
Ellis 9	90	1340
Ellis 10	740	1346
Ellis 11	370	1342
Wentz Oil Corp., Shore 29	90	1347
CALLAHAN COUNTY		
Adams et al, Moore 1	20	1932
Crabtree et al, Seale 1	*	940
Mook-Texas Oil Co., Baum 2	220	1685
Swoveland & Maule, Hall 1	*	1012
COLEMAN COUNTY		
Hudson et al, Curry 1	¶5	1362
Ilseng Prod. Co., Harris 1	¶4	1679
Morrison & St. Johns, Young 2	¶4	1653
EASTLAND COUNTY		
Belva Oil Co., Hamer 1	*	3645
May et al, Owens 1	*	1775
Mook-Texas Oil Co., Sibley 4	2160	3066
T. P. Coal & Oil Co., Cochran 2	50	3053
West Adams Pet. Corp., Ramsower 4	¶18-150	3690
PALO PINTO COUNTY		
Godley O. & G. Co., Dalton 1	*	1420
SHACKELFORD COUNTY		
Albany Oil Co., Reynolds 6	*	1310
Magnolia, Fee (Sec. 56) 3	*	700
Roeser-Pendleton, Inc., Reynolds 1, (Sec. 44)	*	1905

(Continued on page 142)



LENGTH, 62 FEET
DIAMETER, 10 FEET

WELDED PRESSURE VESSELS

Limited to size only by transportation requirements—
Wall thickness up to 3½ inches and heavier . . . . . .

P. I. W. Welded Pressure Vessels are the product of the same organization which has specialized for more than 35 years in tankage and steel plate construction for the oil industry.

Designed especially for the Oil Industry needs and brought into production only after the most exacting and painstaking tests, P. I. W. pressure vessels are establishing new standards of accuracy and strength coupled with minimum upkeep and low first cost.

Write for literature describing an unusual test of P. I. W. Welding.

P.I.W.
STEEL PLATE CONSTRUCTION

Plants:
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PERMITS GRANTED FOR NEW WELLS

WEEKLY COMPARISON OF NEW WELLS

Following is a condensed table giving a comparison of permits or locations made for new wells during the past year in Kansas, Oklahoma, Arkansas, Louisiana, Texas, California and the Mountain States:

	Week Ending Aug. 5	Previous Week	Total This Month	Total This Year	This Week Last Year	This Month 1926	Total Same Date 1926	Year Total 1926
Arkansas	7	8	15	241	13	43	826	910
California	17	18	35	863	25	46	940	1,293
Louisiana	20	11	31	446	22	43	852	1,318
Kansas	..	15	15	636	24	61	1,262	1,745
Oklahoma	..	88	88	2,616	101	203	3,639	5,165
Texas	102	98	200	6,132	221	536	8,432	12,158
Mt. States	..	..	..	340	23	70	404	....
Total	146	238	384	11,274	429	1,002	16,145	*22,589

*Does not include Mt. States.

LOUISIANA

ACADIA PARISH—The Texas Co., Shreveuort, Rayne Heirs 2, 40-9s-2w, 1600 ft easterly along n line from nw c and 200 ft sw parallel to w line.

BOSSIER PARISH — Bethany Oil & Gas Co., Shreveport, J. W. Dodson 2, 16-23n-12w, 660 ft s and 660 ft e of nw c se.

Magonlia, Shreveport, Zula Roberson 1, 23-23n-12w, 660 ft s and 660 ft w of center.

CADDO PARISH—Belchic & Laskey, Inc., Shreveport, R. T. Sharp 1, 23-18n-16w, 3301 ft w and 1980 ft n of se c. Dixie Oil Co., Shreveport, Dillon 90, 14-21-n-15w, 627 ft n and 200 ft e sw c. Magnolia, Shreveport, Minnie Bell 2, 4-17n-16w, 660' s and 660 ft e of nw c. Magnolia, Shreveport, J. W. Furrh 1, 32-18n-16w, 660 ft n and 660 ft w of se c. Standard of La., Shreveport, W. P. Stiles 187, 33-21n-16w, 211 ft n and 1205 ft e of sw c. Standard of La., Shreveport, W. P. Stiles 188, 33- 21n-16w, 423 ft e and 143 ft n sw c. Standard of La., Shreveport, W. P. Stiles 189, 27-21n-16w, 200 ft n and 200 ft w of se c. The Texas Co., Shreveport, Caddo Mineral Lands Co. 50, 23-21n-15w, 330 ft s and 330 ft e of nw c. The Texas Company, Shreveport, J. F. Herndon 9, 14-21n-15w, 330 ft n and 990 ft w of se c.

CALCASIEU PARISH—Vacuum, Houston, Texas, Fee 1, 9-10s-9w, 1040 ft e and 150 ft n of sw c.

OUACHITA PARISH — Industrial Gas & Dev. Co., Sullivan 2-5-18n-4e, 1980 ft w and 660 ft s of ne c.

RICHLAND PARISH — Gulf, Shreveport, Marshfield 2, 29-17n-6e, 1390 ft n and 1250 ft e of sw c. Moody-Seagraves, Shreveport, Hemler 1, 20-16n-6e, 1287 ft w and 602 ft n of se. Moody-Seagraves, Shreveport, McCoy 1, 32-16n-6e, 660 ft s and 1321 ft e of nw c. Natural Gas & Fuel Corp., El Dorado, Ark., Sartor 1, 20-16n-6e, 600 ft s and 900 ft w of c.

WEBSTER PARISH—Magnolia, Shreveport, Waller-O'Bier 1, 32-23n-9w, 660 ft s and 660 ft w of ne c of nw. Magnolia, Shreveport, W. Wise 1, 30-23n-9w, 660 ft s and 660 ft w of ne c se ne.

ARKANSAS

NEVADA COUNTY—Autrey Oil Co., Martin A-2, 6-14-20, 410 ft n and 800 ft e of swc nw sw. J. J. O'Brien, Moss B-3, 1-14-21, 150 ft n and 150 ft e of swc ne se.

OUACHITA COUNTY—Marine Oil Co., Hayes 5-A, 4-16-15, center w line ne ne; Snyder 15,34-15-15, nwc nw sw.

UNION COUNTY—Skelly Oil Co., Roper 12, owd, 3-16-15, sec ne sw. Smitherman & McDonald, Saxon B-4, owd, 5-16-16, center e line sw ne. Stewart et al, Murphy 7, owd, 9-16-15, center w line e½ ne sw

CALIFORNIA

COALINGA—Premier Oil Co., 24, 24-20-14.

CONEJO—Marilou Oil Co., 53, 33-2-20.

GOLETA—Miley Oil Co., Goleta 9, 3-4-29.

HUNTINGTON BEACH — Globe Lease & Royalty Co. 3, 27-5-11. Standard Oil Co., Bolsa 31, 4-6-11. Bell of Montebello Oil Co., 5-A, 2-6-11. Harry B. Custer 2, 34-5-11.

KERN RIVER— Wonder Co., Ltd., 13, 23-28-27. Standard Oil Co., 12, 15-28-27. F. C. Grimes & Associates Guerrier 1, 14-28-28; Dorwart 1, 14-28-28; Hortshorn 1, 14-28-28.

LONG BEACH—The Petroleum Co., Nuttig-Lough 2, 24-4-13. Stevens Drilling Co., Steve 2, 24-4-13.

MIDWAY—Standard Oil Co., 235, 7-32-24.

RICHFIELD—California Petroleum Corp., Bradford 7, 32-3-9.

VENTURA — Scott Petroleum Properties, Inc., Rincon 1, 35-4-25.

TEXAS

ARCHER COUNTY — Texas Co., Wichita Falls, Turbeville C 18, blk 172, R. Carson sur, 400 ft w of 12. McConnell Bros., Wichita Falls, Wilson 1, blk 103, Amer. Trib. 1470 ft to n and 450 ft to w line. R. E. Carter, Wichita Falls, Wilson 1, W. Horritz sur, 150 ft to s and e lines. John O'Neil, Wichita Falls, Wilson 1, Wm. Horritz sur, 150 ft to n and e lines. Farmer 1, Poitevent sur, 1100 ft to w and 150 ft to s line Tranan & Marland Co., Wichita Fall, McCrory 1, S 1, S. P. Ry. sur, 150 ft to s and w lines. Maer & Staniforth, Wichita Falls, Wilson 15, DL&C sur, 300 ft e of No. 13. J. P. Rayzor et al, Wichita Falls, Key 1, blk 42, Club Ranch sur, 750 ft to w and 150 ft to n line. Shappell Oil Co., Wichita Falls, Wilson B 13, S. P. Ry. sur No. 4, 500 ft to w and 800 ft to s line.

AUSTIN COUNTY — Humble, Houston, Sherrod 1, W. C. White sur, 2050 ft to n and 450 ft to w line.

BROWN COUNTY—Humble, Houston, Byler 2, S 43, T&NO sur, 335 ft w of 1; Kilgore D10, J. Delgado sur, 395 ft to n and 431 ft to e line; Kilgore B18, T. Benson sur, 2370 ft n of 4. Texas Co., Wichita Falls, Hickman 22, 783, T. Benson sur, 300 ft n of 11. Cranfill & Reynolds, Cisco, Smith 2, S 3, SA&MG sur, 300 ft s of 1; 3, 150 ft to n and e lines. Roxana Pet. Corp., South Bend, Smith 5, S 1, blk X, SA&MG sur, 150 ft to w and 856 ft to s line; 1, 168 ft to w and 150 ft to s line; 2, 474 ft to w and 150 ft to s line. Symplex Synd., Colorado Springs, Colo., Byler 6, S 43, T&NO sur, 450 ft to n and 640 ft to e line. Charter Oil Co., Brownwood, Byler 3, No. 43, Brownwood, Mauldin 1, S 80, T. C. Strawn, T&NO sur, 347 ft w of 2. A. H. Brown, ne corner. G. P. Mitcham, Cisco, Keeler 1, J. Padilla sur, 720 ft to n and 450 ft to e line.

BRAZORIA COUNTY—Roxana, Houston, Bell 2, T. B. Bell sur, 1218 ft to n and 50 ft to river.

CALLAHAN COUNTY — Shackleford Oil Co., Putnam, Thomson 2, 2296, TE&L sur, 300 ft s of 1. Charles Denny, Putnam, Beck 1, No. 3, J. D. Donothan sur, 200 ft to e and 450 ft to s line. W. B. Flynn & Co., Beaumont, 1, 900 ft to n and 470 ft to w line. Gordon & Meredith, Moran, Diller 1, S 54, L. A. L. sur, 630 ft to n and w lines. Warren-Hayes Oil Corp., Cisco, Brandon 1, 2267, TE&L sur, 1000 ft to n and 900 ft to s line. A. H. Volz, Brownwood, Brandon 1, S 3, GC&SF sur, 300 ft to sw and 320 ft to se line. Prairie O. & G. Co., Ranger, Baum 2, G. M. Vigal sur, 150 ft to s and e lines; 3, 150 ft n of 2. Moutray Oil Co., Abilene, Hickman 7, S 149, BBB&C sur, 447 ft to w and 770 ft to n line; Flores 18, S 149, BBB&C sur, 1005 ft to w and 1510 ft to s line. V. H. Martin, Baird, Jackson 1, S 523, J. O. Young sur, 750 ft to n and e lines. McGinley Corp., Fort Worth, Gray 9, S 111, Univ. Lands sur, 450 ft to w and 150 ft to s line.

COOKE COUNTY—Gainesville O. & Dev. Co., Gainesville, Whaley Co. 1, blk 58, Muenster sur, 150 ft to s and w lines. Texas Co., Wichita Falls, Dennis 4, T. J. Hutchinson sur, 400 ft n of 2. Oil Operator's Trust, Fort Worth, Koelzer 2, blk 13, T. Scott sur, 150 ft to s and 115 ft to w line. Killiam & Dugan, Dallas, Whaley & Jones 1, BB&C sur, east central. Abernathy, Clark & Melate, Fort Worth, Dayton 2, F. Godley sur, 150 ft to s and 990 ft to e line.

CLAY COUNTY — O. L. Soules Oil Co., Burkburnett, Landrum 4, blk 5, P. C. S. L. sur, 960 ft to n and 150 ft to w line.

CROCKETT COUNTY—R. M. Bleakie, San Antonio, Todd 1, S 43, blk WX, GC&SF sur, 1199 ft o n and 1434 ft to e line. Young & Donnelley, Big Lake, Massie 1, S 28, blk UV, GC&SF sur, 200 ft to w and 150 ft to s line.

COLEMAN COUNTY — Hoffer Oil Corp., Fort Worth, Cameron 2, No. 495, J. A. H. Cleveland sur, 3000 ft e of center of w line.

CRANE COUNTY—Simms Oil Co., Dallas, University D 8, S 46, blk 30, Univer. Lands sur, 660 ft w of 1; 9, 660 ft w of 8.

COMANCHE COUNTY—D. Breeding, Rising Star, Morgan 1, S 59, J. Shelton sur, 200 ftto e and 1200 ft to s line.

DUVAL COUNTY—Houston Oil Co., Houston, Lopez B1, S 319, blk 4, 155 ft to ne and 460 ft to se line.

EASTLAND COUNTY — Hazlip & Curry Bros., Eastland, Reynolds 1, S 20, H&TC sur, 700 ft to e and 175 ft to s line. Root & Feil, Eastland, Watson 3, S 37, blk 4, H&TC sur, 300 ft to n and w lines. Morrison, Goolsbee & Davis, Cisco, Collins 1, S 3, H&TC sur, 810 ft s of center of n line. Chestnut & Smith Breckenridge, Griggs 1, blk 3, A. Miller sur, 990 ft to e and 907 ft to s line. Texas Co., Wichita Falls, Hightower 17, blk 1, W. Van Norman sur, 2408 ft to w and 457 ft to s line. Panhandle Ref. Co., Wichita Falls, Hightower 8, S 3, W. Van Norman sur, 300 ft w of 2.

FORT BEND COUNTY—Sun Oil Co., Dallas, Fermer 2, J. Scott sur.

HOWARD COUNTY—Marland, Fort Worth, Guitar A1, S 14, BBB&C sur, center of sec. California Co., Colorado, Fisher 1, S 36, blk 33, T&P sur, 2300 ft to n and 990 ft to w line.

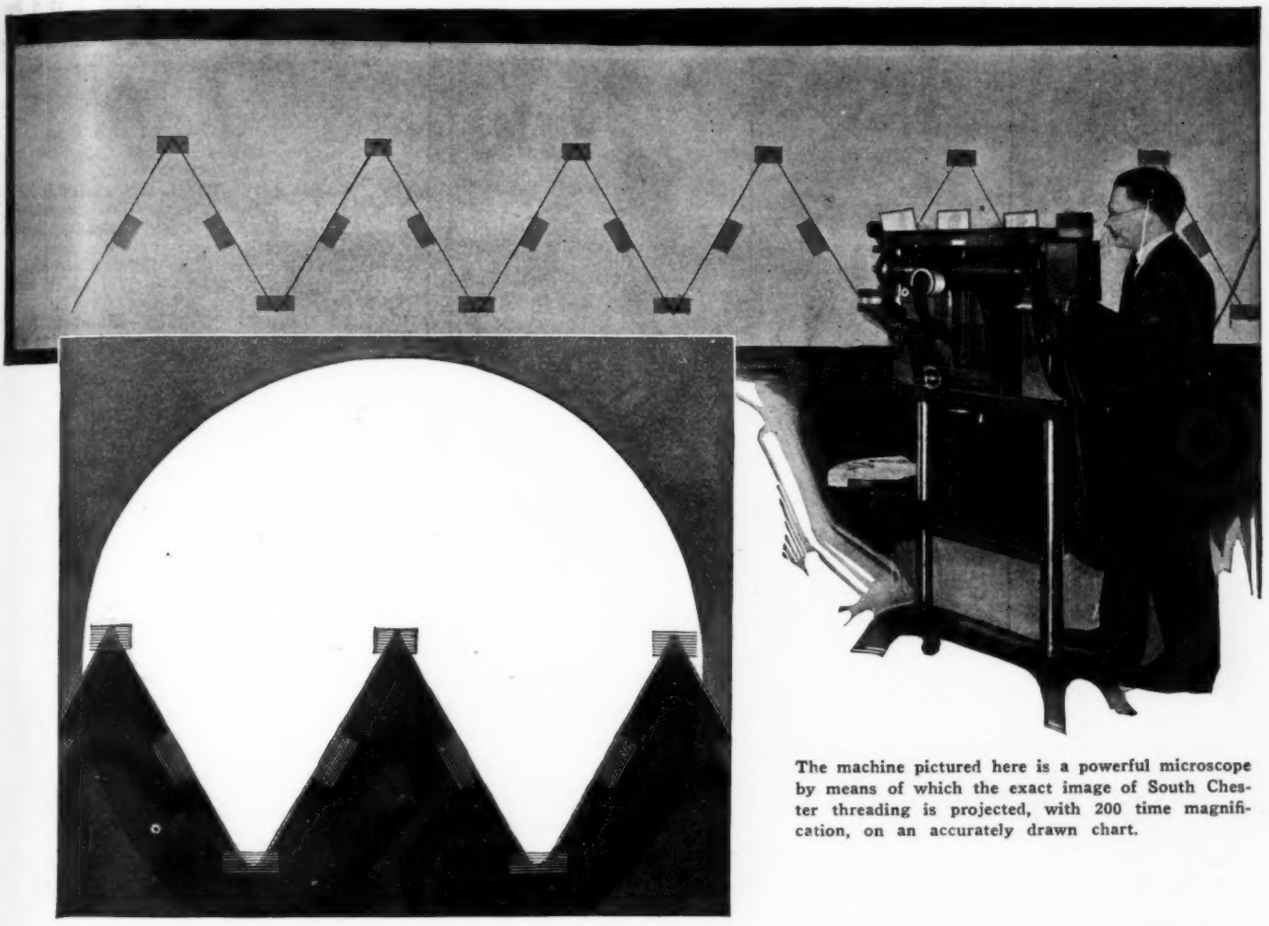
HUTCHINSON COUNTY — Phillips & Wills, Amarillo, Smith 1, S 7, blk y, M&C sur, ne corner; Smith 4, S 14, sw corner.

HARDEMAN COUNTY — Milham Corp., San Antonio, Reeves 1, S 2, 3822 ft to n and 1391 ft to e line.

HARRIS COUNTY—Rio Bravo, Houston, Settegast A A6, 1, 750 ft J. Kopman sur, 1750 ft to n and 100 ft to e line. Marsalis Bros., Humble, Sullivan 1, James Strange sur, 50 ft e of center of w line.

JACK COUNTY—Buttram Pet. Corp., Oklahoma City, Jones 2, No. 5, S. P. Ry. sur, 500 ft s of 1. F. P. Zoch, Fort Worth, Cherry-homes 1, E. Robinson sur, 550 ft to w and 782, to s line.

JEFFERSON COUNTY—Young Yount-Lee Oil Co., Beaumont, Gladys 37, blk 99, J. A.



The machine pictured here is a powerful microscope by means of which the exact image of South Chester threading is projected, with 200 time magnification, on an accurately drawn chart.

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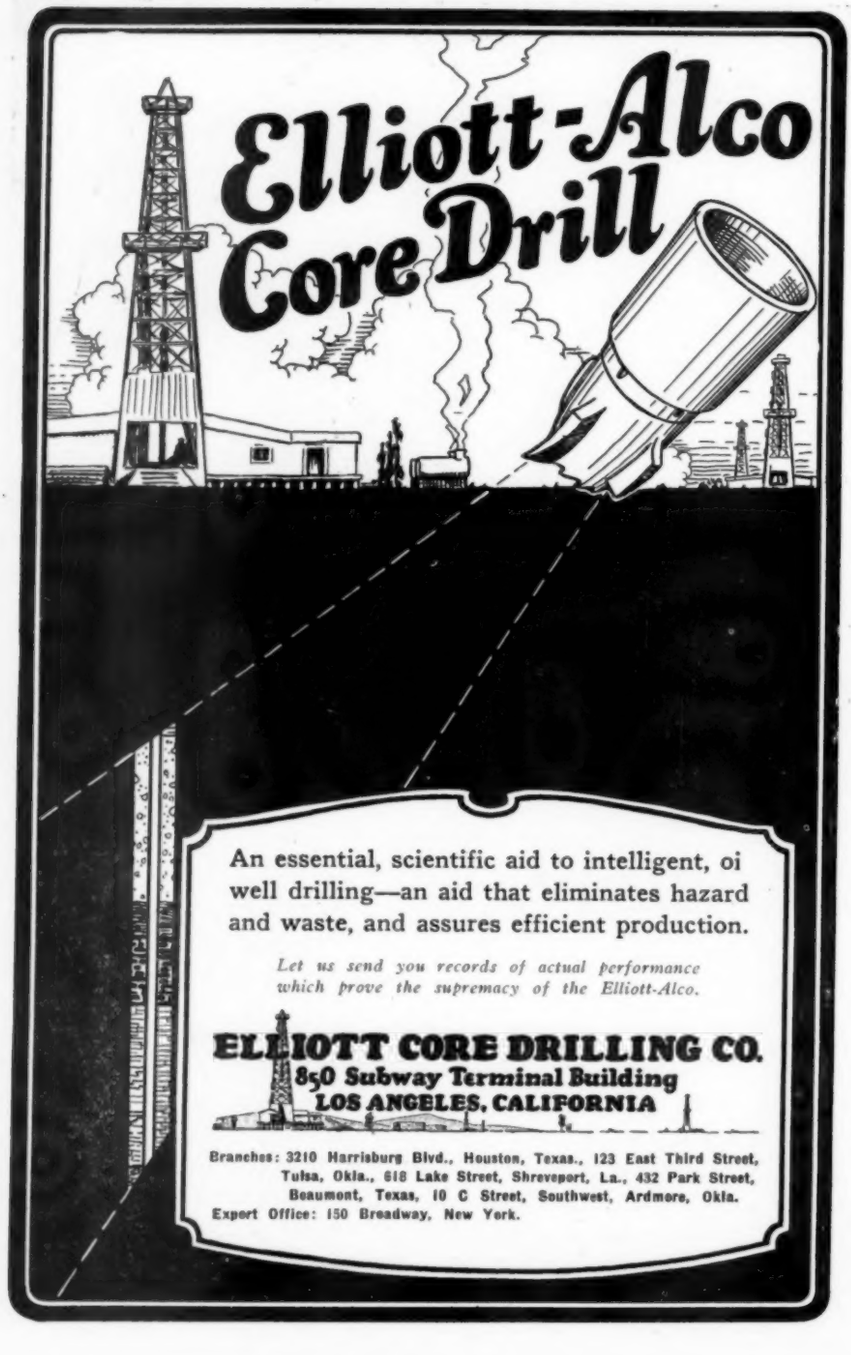
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Veatch sur, 110 ft to n and 9 ft to e line; McFaddin 39, blk 1, P. Humphreys sur, 1376 ft to e and 1087 ft to n line. Jim McMurrey, Fort Worth, Crosby 1, Port Arthur Land Co., nw corner.

KARNES COUNTY—H. A. Ellis, San Antonio, E. Henke 1, nw corner.

LYNN COUNTY — C. E. Simmons, Fort Worth, Lumeden 1, S 6, blk C42, School sur, 200 ft to n and 300 ft to w line.

MILAM COUNTY — McCormick & Noack, Rockdale, Shelton 2, Wm. Allen sur, 300 ft se of 1. Coffield & Hale, Rockdale, Stephens 2, James Reese sur, 10 ft n of 1.

MEDINA COUNTY—Witherspoon Oil Co., San Antonio, Nixon 3, No. 119, I&GN sur, 50 ft w of 2.

MONTAGUE COUNTY—Humble, Wichita Falls, Hinton 1, A. Coats sur, 150 ft to n and e lines.

PALO PINTO COUNTY—Burton, McKee Oil Corp., Strawn, Strawn Coal Co. 6, A. Ashworth sur, 4750 ft to e and 5750 ft to s line. H. C. Dickey et al, Fort Worth Chenault 1, blk 15, S. Townsend sur, 450 ft n of center of s line.

PANOLA COUNTY—Magnolia, Dallas, Jennings 2, J. Tharpe sur, 330 ft to s and e lines.

SHACKLEFORD COUNTY—Magnolia, Dallas, Fee 4, S 70, Univ. Lands sur, 600 ft s of 3. T. G. Shaw, Fort Worth, Owens 13, S 20, Bayland Asy. sur; Edgar 1, S 20, Bayland Asy sur, 150 ft to s and w line; 2, 300 ft n of 1; 3, 300 ft e of 1. Brotherhood 22, S 36, Univ. Lands sur, 300 ft s of 18. Ray T. Hoff, Moran, Snyder 1, S 38, L. A. L. sur, 450 ft to s and w lines. W. S. Duty, Abilene, McLemore 3, M. A. Wood sur, se corner. Ed. Wilson, Moran, Jones 1, S 72, L. A. L. sur, 150 ft to n and 300 ft to w line. Texas Cons. Oil Co., Ivan, Isabell 3, 818, TE&L sur, 900 ft to n and 450 ft to e line.

STEPHENS COUNTY — Prairie O. & G. Co., Ranger, Proctor 2, 1325, TE&L sur, 330 ft to n and w lines.

TOM GREEN COUNTY—R. O. Haubelt, San Angelo, Johnson 1, S 164, C. Keiser sur, 150 ft to s and e lines.

UPTON COUNTY — J. M. Hickey, Cisco, McKinley 1, S 7, N 36, H&TC sur, 1650 ft to w and 330 ft to n line. Humble, Houston, Ricker 6, No. 5, M. S. Denton sur, 1564 ft se of 5.

WHARTON COUNTY—Texas-Gulf Sulphur Co., Houston, Bay 1, S. F. Austin sur, 50 ft to sw and 450 ft to se line; Robbins 1, Bear Camp Plantation sur, 248 ft to ne and 1394 ft to se; Allen 1, S. F. Austin sur, 50 ft to nw and 450 ft to sw line; Cloud 1, S. F. Austin sur, 100 ft to se and 1002 ft to sw line; Banker 1, S. F. Austin sur, 878 ft to sw and 361 ft to se line; Kostelnik 1, S. F. Austin sur, 2150 ft to sw and 1000 ft to se line.

WISE COUNTY—L. M. Lamar, Graham, Moore 1, Brown sur, 150 ft to w and 320 ft to s line.

YOUNG COUNTY—Conner, Son & Clangley, Wichita Falls, McChesney 10, S 2, S. Tankersley sur, 150 ft to n and w lines. W. R. Stafford, Graham, Dyer 2, L. E. Hardin sur, 150 ft to n and w lines. Rhea, Anderson et al, Olney, Jones 1, No. 26, TE&L sur, 150 ft to e and 1156 ft to s line. F. P. Rose, Wichita Falls, Casey 1, 1494, TE&L sur, 150 ft to s and w lines.

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Associated Running New Casing in Potrero Test

Los Angeles, Calif.—A partial test was given the Associated Oil Company's Cypress well on the Potrero structure, near the city limits, and the results were so satisfactory that the company will run a full oil string with sufficient perforations to make another test soon. The well has been somewhat of a mystery since its shutdown last spring. Its action on the recent test indicated that it may yet become a commercial producer. During the bailing test, the well showed some signs of flowing.

WILDCATS FROM ALL SECTIONS

LOUISIANA

Completions

Company, Well and Location	Initial Production Bbls.	Depth
CADDO PARISH—		
Magnolia, Dillion 16, 24-21-15	*	1750
The Texas Co., Alexander 1, 27-18-16	*	1890
CLAIBORNE PARISH—		
Rudeseale et al, Meadows 1, 20-21-7	*	2300
LA SALLE PARISH—		
Tunica Pet. Co., L. & A. 37, 8-7-2e	*	762
RED RIVER PARISH—		
Alden Oil Co., Powell 1, 13-11-10 ..	*	2838

BIENVILLE PARISH — E. J. Forrest's Perritt 1, 11-17-6, rig. Kimborugh et al's Cargyle 1, 27-15-8, sd 1780 ft.

BOSSIER PARISH—Doern et al's Thomas 1, 9-22-11, making Lewis test at 3138 ft. Humble O. & R. Co.'s B. & W. 30, 15-19-11, dr 3551 ft. Magnolia's Rogers 1, 21-23-12, dr 2430 ft; Dodson 1, 16-23-12, rig; Roberson 1, 26-23-12, lcn. Palmer Corp.'s Bossier L. & L. Co. 4, 9-16-11, dr 5028 ft. Simms Oil Co.'s Dodson 1, 15-23-12, rig. The Texas Co.'s Mays 1, 27-23-12, sd 2685 ft. Walker et al's Antrim 1, 28-22-13, sd 1360 ft. Woodley & Collins' J. S. Farrington 1, 23-23-12, set 12-in at 450 ft; M. A. Farrington 1, 22-23-12, dr 1200 ft; Matlock 1, 23-23-12, set 10-in at 803 ft.

CADDO PARISH—Arkansas Fuel Oil Co.'s Lone 2, 13-21-15, dr 3495 ft. Bemedum & Trees' Huckaby 1, 14-21-15, set 10-in at 2255 ft; Bashara 1, 23-21-15, dr 3535 ft; Bashara 2, 23-21-5, rig. Bayou State O. & G. Co.'s Hoss 32, 24-22-15, sd 700 ft. Bethany O. & G. Co.'s Offenhauser 1, 1-20-16, set 4½-in at 2245 ft. Dixie Oil Co.'s C. M. L. 49, 23-21-15, rig; Files-Mabry B-6, 14-21-15, dr 70 ft; Slattery 10, 27-21-15, dr 3998 ft; Noel A-2, 13-21-15, fsh 3868 ft; Mabry B-5, 14-21-15, blg 3767 ft; Robertshaw 89, 14-21-15, dr 1800 ft. J. P. Evans Trosper 1, 35-18-16, dry at 919 ft; Trosper 2, 35-18-16, lcn. J. B. Files Payne 1, 35-23-16, sd 925 ft. Falcon Drlg. Co.'s Schmidt 1, 27-20-15, dr 125 ft. Gilliam Synd.'s Taylor 1, 17-21-14, sd 914 ft. J. C. Gray et al's Hart 1, 29-21-16, sd 600 ft. Greenwood Prod. Co.'s Agurs 2, 6-16-16, coring 2927 ft; Thigpen & Herold 1, 23-18-16, sd 910 ft; Thigpen & Herold 2, 24-18-16, ig. Bickham 1, 23-18-16, set 8-in at 901 ft. Gulf Ref. Co.'s Tyson 14, 14-21-15, dr 2637 ft; Tyson 15, 14-21-15, set 8⅝-in at 2336 ft; Herndon 10, 15-21-15, dr 1886 ft. Golden Rod Oil Co.'s Hampton A-1, 15-21-15, dk; B. A. Hardy's Tr.s's Bickham 1, 23-18-16, sdtr at 2175 ft. Haynes Bros.' Murray 2, 14-21-15, set 8¾ in at 2303 ft; Spell 1, 15-21-15, dr 2810 ft. Industrial O. & G. Co.'s Sharp 1, 22-18-16, sd 2615 ft. Bert Kouns' Hoss 1, 35-18-16, dk; Hoss 2, 35-18-16, lcn. Magnolia's Bell 1, 4-17-16, r 2576 ft; Furrh 1, 28-18-16, dr 739 ft; Dillon 18, 24-21-15, dk; Dillon 21, 23-21-15, lcn; Robertshaw 21, 23-21-15, set 10¾-in at 2385 ft; Raines 26, 22-21-15, dr 202 ft. Ohio Oil Co.'s Aaron B. Land Co. 1, 32-23-16, sd 1553 ft; Plum 1, 32-23-16, sd 1619 ft; Smith 25, 12-21-15, set 6⅝-in at 4603 ft. Pittsburgh O. & D. Co.'s Huckaby 1, 15-21-15, dr 1500 ft; Herndon 1, 15-21-15, dr 2200 ft. Shawmut Pet. Co.'s Jolly 5, 22-22-15, lcn. Shreveport Oil Corpn's State 1, 23-21-16, dk; State 2, 27-21-15, sd 2400 ft. Simplex Oil Co.'s Thomas et al 3, 15-20-15, wosr 2355 ft. Standard's Trosper 2, 34-18-16, dr 2774 ft; Stiles 182, 33-21-16, wosr 1838 ft; Stiles 187, 33-21-16, dry at 1862 ft. State Line O. & G. Co.'s Wheeler 1, 16-18-16, sd 986 ft; Thigpen-Herold 2, 26-18-16, sd 891 ft; Thigpen & Herold 5, 28-18-16, dk. The Texas Co.'s C. M. L. Co. 47, 23-21-15, waiting for rig, 3657 ft; Mabry 10, 15-21-15, dr 193 ft; C. M. L. 49, 23-21-15, rig; Hutchinson 4, 9-15-12, arr to test 1644 ft; Herndon 5, 14-21-15, arr to test 2677 ft; Herndon 6, 14-21-15, dr 2336 ft; Herndon 8, 14-21-15, sd 2379 ft; Herold 9, 14-21-15, dr 157 ft; Herold 10, 14-21-15, lcn; Raines 19, 15-21-15, dr 204 ft. Tubbs et al's Hines 1, 9-14-16, rig. Woodley Pet. Co.'s Knight B-1, 3-15-12, set 6⅝-in at 1912 ft.

CALDWELL PARISH — Grayson Oil Co.'s Crockett 1, 6-12-4, sd 2962 ft. Southern Crude Oil Purch. Co.'s Caldwell L. & T. Co. 8, 5-13-5e, sd 147 ft.

Company, Well and Location	Initial Production Bbls.	Depth

CATAHOULA PARISH — S. D. Hunter's Tensas Delta 2, 21-9n-6e, rig. Lochnager O. & G. Co.'s Beasley 1, 26-9-6e, r 3093 ft.

CLAIBORNE PARISH—Magnolia Pet. Co.'s Lee 1, 16-22-8, dr 3941 ft.

DE SOTO PARISH—Berry & Le Grande's Giauque 1, 3-10-11, dk. Clark & Melats Payne 2, 12-11-16, dr 1700 ft. Chal Daniels et al's Johnson 1, 1-11-16, set 10-in at 40 ft. Dixie Oil Co.'s Jenkins 1, 9-12-11, dr 5447 ft. Helm & Jarman's Joyner 1, 28-11-12, sd 3018 ft. Hoosier Oil Co.'s Lanier 2, 5-11-11, lcn; Lanier 1, 5-11-11, lcn. Reliance Drlg. Co.'s Jones 1, 8-11-14, sd 2815 ft. W. M. Sebastian Synd.'s Sebastian 1, 11-10-13, sd 3405 ft. The Texas Co.'s Sample C-15, 36-13-12, r 2501 ft; Wemple A-6, 2-12, wt on ct at 2400 ft. Brinkerhoff B-36, 30-10-13, dr 1432 ft.

FRANKLIN PARISH — T. R. Cowell's Moore 2, 12-11-6e, dr 200 ft. Barbour Oil Co.'s Baker 1, 3-15-7e, arr to deepen 2796 ft.

GRANT PARISH — Holmes et al's Fee 2, 17-9-1e, dr 1410 ft. L. C. Swope et al's Fee 3, 18-9-1e, arr to plug back to 1607 ft; Fee 4, 18-9-1e, dr 280 ft.

JACKSON PARISH—Grigsby et al's Adams 1, 22-17-4w, sd 2900 ft. Houseman et al's Norton 1, 34-15-3w, sd 400 ft.

LA SALLE PARISH—Ayers Bros.' Urania 5, 30-10-2e, dr 500 ft. Hope O. & G. Co.'s Urania 4, 19-10-2e, sd 300 ft. Natural Gas & Fuel Corp.'s Urania M-10, 19-10-2e, set 6-in at 1552 ft. Tunica Pet. Co.'s L. & A. 35, 9-7-2e, wosr 782 ft.. Wingfield et al's Gibson 2, 2-9-1e, set 6⅝-in at 1493 ft.

MOREHOUSE PARISH — Cons. Carbon Co.'s Perry 1, 14-20-4e, lcn. W. C. Feazel's Faulk 1, 15-20-4e, dr 150 ft. Falcon Drlg. Co.'s Gladney 1, 5-21-7e, tested sw at 2583 ft. Natural Gas Prod. Co.'s Crossett 20, 21-23-7e, dr 2820 ft. The Texas Co.'s Silvey 1, 22-20-6e, set 15½-in at 172 ft. United Carbon Co.'s Atkins 1, 26-20-5e, dk.

Company, Well and Location	Initial Production Bbls.	Depth

NACHITOCHES PARISH—Ohio Oil Co.'s L. & A. 2, 26-13-6w, tested sw at 2262 ft. Tate et al's Leopole 1, 4-10-10, lcn.

OUACHITA PARISH—J. S. Gould's Grayling Lbr. Co. 1, 11-15-2e, rig. Industrial Gas Co.'s Sullivan 1, 5-18-4e, rig. Jordan Drlg. Co.'s Fudicar 2, 25-18-4e, sd 2648 ft. Louisiana Dev. Co.'s Fee 43, 35-19-2e, dr 110 ft. Ouachita Natural Gas & Oil Co.'s D'Arbonne 2, 25-19-2e, sd 2780 ft. Ouachita Gas Co.'s Leiber 4, 3-19-4e, dr 185 ft. Peerless Co.'s Moore 3, 49-20-4e, lcn.

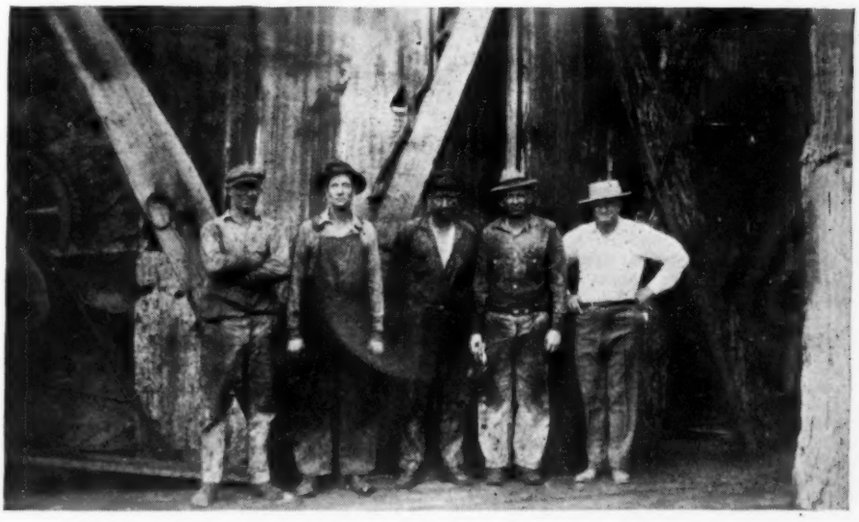
RAPIDES PARISH—Minnesota Oil Corp.'s Wattermack 1, 7-5-3w, sd 2997 ft. George Sebatier's Ritchie 1, 38-5-4, sd 2750 ft. Seip et al's Brewer 1, 38-3-2e, dr 1545 ft.

RED RIVER PARISH — Hazlett-Simmons' Neeley 1, 1-14-12, arr to test 1712 ft.

RICHLAND PARISH — Gulf. Ref. Co.'s Wayne L. & T. Co. 1, 36-17-5e, arr to abn 3052 ft; Seibert 2, 11-16-5e, sdtr ds 2491 ft; Ouachita National Bank 1, 25-17-5e, dr 421 ft. S. D. Hunter's Seibert 1, 1-16-5e, sd 2358 ft. Helm et al's Tensas 1, 10-14-5e, dk. Louisiana Pet. Co.'s Binion 1, 22-17-6e, sd 2474 ft. Oliver et al's Hatch 1, 2-15-5e, sd 2316 ft. Ruston Drlg. Co.'s McCoy 1, 30-16-6e, set 6-in at 2300 ft; McCoy 2, 8-16-6e, set 8-in at 878 ft. Standard Drlg. Co.'s Delta H. L. Co. 1, 22-16-7e, sd 200 ft. Tex-La Carbon Co.'s Broughton 1, 1-15-6e, sd 2602 ft.

SABINE PARISH—Arkansas Fuel Oil Co.'s Logan A-1, 23-10-12, dr 2816 ft; Logan 9, 33-10-12, dr 3280 ft; Logan 10, 32-10-12, dr 3718 ft; Logan 11, 33-10-12, lcn. Emlet et al's Bowman Hicks 5, 8-7-12, sd 3229 ft; Bowman Hicks 6, 8-7-12, arr to deepen 3710 ft; Bowman Hicks 7, 11-7-14, set 8-in at 2502 ft; Bowman Hicks 8, 16-7-12, sd 579 ft; Mansfield H. L. Co. 1, 15-7-14, sd 515 ft. Foster et al's Harris 1, 29-10-12, dk. Longoria et al's Burkett 1, 9-9-13, dk. H. I. Morgan's Reese 1, 5-9-12, dry at 3385 ft. Magnolia's Rembert 1, 32-10-12, set 6-in at 3150 ft; Hall 2, 33-10-12, rig. Moffatt et al's Moore 2, 5-9-12, dk. Tate et al's Cook Land Co. 1, 23-10-11 dr 2498 ft.

Drill Southwest's Deepest Hole



Here's a line-up of the crew who drilled the Texon Oil & Land Company's University 1-B, Group 1, the deepest producer in the Southwest. It has 3500 feet of 38.7 gravity oil in the hole from pay at 6284-6573 feet. Drilling will be resumed. Five and three-sixteenths inch casing is set at 4228 feet with 2345 feet of open hole. The crew includes, (left to right) R. L. Lunsford and William Clifton, drillers; T. H. Smith and L. H. Lunsford, tool dressers; and J. E. Willoughby, production superintendent.

A. H. Tarver's Long Leaf Lbr. Co. 1, 5-8-13, set 12½-in at 204 ft.

UNION PARISH—Camette et al's Tugwell 1, 21-22-1e, sd 2405 ft; Tugwell 2, 21-22-1e, lcn. Interstate Natural Gas Co.'s Parks 1, 23-20-3e, dk. Natural Gas Prod. Co.'s Peak 2, 12-20-3e, arr to test 2158 ft; Peak 3, 5-20-4e, rig.

WEBSTER PARISH—Crusader Oil Prod. Co.'s Hope 18, 24-21-10, dk. W. T. Hunt's Pistineau-Webster Oil Co. 1, 35-18-10, sd 1040 ft. Magnolia's Cox 3, 23-21-10, dr 3846 ft; Branton 2, 6-22-9, rig; Aarnes-Cox 3, 22-21-10, dk; Marshall 3, 21-21-10, set 6¾-in at 2544 ft; Marshall 4, 21-21-10, rig; O'Bier 1, 32-23-9, dr 2601 ft. Ohio Oil Co.'s Bank of Cotton Valley 2, 22-21-10, dk; Bank of Cotton Valley 4, 22-21-10, dr 4576 ft. Shreveport- El Dorado Pipe Line Co.'s Gamble 1, 33-20-3, dr 2267 ft. Woodley Pet. Co.'s Cox B-1, 23-21-10, set 6¾-in at 4107 ft.

WINN PARISH—Cherokee Pet. Co.'s Albritton 1, 27-10-1e, sd 900 ft. Dodge et al's Tremont 1, 35-13-3w, sd 1420 ft. H. L. Hunt's Tremont 1, 27-10-1e, sd 1588 ft. J. C. Long's Milam 1, 28-13-3w, sd 1550 ft. Ohio Oil Co.'s Rolem 1, 9-12-1w, dr 965 ft. Rowe et al's Urania 1, 26-11-1e, dk. F. A. Schuman's Albritton 1, 27-10-1e, sd 1518 ft.

WEST CARROLL PARISH—Phillips Pet. Co.'s Darnell Lbr. Co. 1, 32-20-9e, dr 738 ft. Palmer Corp's Pioneer Cooperage Co. 1, 16-20-10e, dr 1500 ft.

ARKANSAS

Company, Well and Location	Initial Production Bbls.	Depth
HEMPSTEAD COUNTY—		
Arkansas Natural Gas Co., Goodlet 1, 34-10-26	*	1841
NEVADA COUNTY—		
Holmes et al, Wallace 1, 11-14-21	*	1200
OUACHITA COUNTY—		
Unity Pet. Co., Umsted A-8, 33-15-15	*	2398
UNION COUNTY—		
W. D. Wingfield Tr., Hadley 1, 2-18-13	*	3090

ASHLEY COUNTY—Glassell et al, Keller 1, 10-19-5, fsh dr stem 1370 ft.

BRADLEY COUNTY—Johnson & Adams' Southern Lbr. Co. 1, 12-12-12, sd 2204 ft.

COLUMBIA COUNTY—Columbia Oil Synd.'s Whitehead 1, 14-19-23, sd 2350 ft. Haynes et al's Runyon 1, 3-16-21, sd 525 ft. Mitchell et al's Franks 1, 25-19-22, sd 150 ft. Mitchell & Isles' Bodcaw 2, 4-20-21, sd 2804 ft. Maier et al's Gantt 1, 15-17-22, dk. Scott Phillips' Davis L. & I. Co. 2, 6-18-20, sd 2145 ft. Tunica Pet. Co.'s Bodcaw 1, 27-19-23, dr 1620 ft. Wingfield et al's Bodcaw 1, 4-20-21, sd 2025 ft.

CLARK COUNTY—Wheelen Oil Co.'s Barrows 3, 35-10-20, coring 1325 ft.

DREW COUNTY—McClintock et al's Ogle 1, 35-13-5, sd 2550 ft.

GRANT COUNTY—Jones et al's Meeks 1, 5-4-11, dr 1210 ft.

LAFAYETTE COUNTY—Ken-Saw Pet. Co.'s Red River Lbr. Co. 2, 5-20-24, sd 2840 ft.

LINCOLN COUNTY—Pine Prairie O. & G. Co.'s Carter 1, 33-10-6, r 2020 ft.

LITTLE RIVER COUNTY—Grote et al's Allen 1, 2-13-31, sd 2941 ft.

NEVADA COUNTY—Aines & Zingg's Womack 1, 10-14-21, dr 500 ft. Autrey Oil Co.'s Haynie 1, 6-14-20, wosr 1169 ft; Martin A-2, 6-14-20, dk. Burnham et al's Miller 1, 12-15-22, dr 580 ft. Fruen et al's Rhodes 1, 23-12-21, sd 1515 ft. J. J. O'Brien's Martin 2, 6-14-20, bailing 1199 ft; Moss B-2, 1-14-21; Moss B-3, 1-14-21, dk.

OUACHITA COUNTY—Buffalo Oil Co.'s Culp 3, 22-15-19, dr plug 1487 ft. Brewer et al's Curry 1, 32-15-19, rig. F. A. Book Tr.'s Johnette 3, 33-15-16, pulling liner 2280 ft. Copenhagen et al's Berg 3, 13-15-17, sd 2193 ft. J. E. Crosby's Berry 15, 33-15-15, set 6⅝-inch at 2361 ft. Exchange Oil Co.'s Berg 4, 4-16-15, arr to test at 2359 ft; Berg 8, 4-16-15, arr to deepen 2352 ft. A. Grayson's Reynolds 1, 21-14-17, sd 1744 ft. Magnolia's Morgan 1, 7-15-19, fsh 3030 ft; Stout B-1, 28-14-16, tested sw at 2108 ft. Marine Oil Co.'s Hayes 5-A, 4-16-15, lcn; Hayes 8, 4-16-15, arr to deepen (depth not known); Snyder 13, 34-15-15, set 6⅝-inch at 2623 ft; Snyder 15, 34-15-15, dk. Phillips Pet. Co.'s Joyce 15, 33-15-15, co 2351 ft. J. D. Reynolds' Chandler 1, 3-14-18, arr to abn 1900 ft.

UNION COUNTY—Brown et al's Slaughter 1, 2-17-16, sd 2296 ft. Bondurant et al's Garner 1, 8-18-12, sd 2635 ft. Crescent Oil Co.'s Saxon 1, 5-16-16, sd 53 ft. W. H. Gilliland's Hodges B-1, 1-16-17, sd 2565 ft. Grimes & Jones' Hill 1, 7-18-14, wosr 2236 ft. Gulf Ref. Co.'s Murphy 45, 4-16-15, dk. Imperial O. & G. Co.'s Murphy 5, 9-16-15, fsh 2565 ft; Goodwin 1, 26-17-16, sd 3118 ft. E. M. Jones' Alphin 2, 4-16-15, wosr 2351 ft. W. R. Keever's Ezell 2, 12-17-15, arr to test 2883 ft; Ezell 3, 12-17-15, lcn. Keene & Wolfe's Murphy 6, 9-16-15, dk. Lyall et al's Stegall 1, 11-17-13, sd 47 ft. Lion O. & R. Co.'s Craig 1, 4-18-18, dr 3272 ft; Hayes 6, 4-16-15, dr 1960 ft. Magnolia Pet. Co.'s Crawford 3, 8-16-16, dk; Laney 3, 8-16-16, dk; Laney 4, 8-16-16, dk; Murphy 3, 8-16-15, coring 2599 ft; Wilson 6, 17-16-15, recemented casing 2500 ft; Wilson 7, 17-16-15, dk; Carroll 1, 1-17-14, dr 150 ft. Mazda Oil Corp.'s Boyd 1, 9-17-15, coring 1967 ft. Mounts et al's Pratt 6, 8-18-15, arr to re-cement at 2146 ft. Murdock et al's Vestal 1, 17-16-15, sd 2561 ft. National Cons. Pet. Co.'s W. A. Fagg 1, 8-16-16, coring 2623 ft. Natural Gas & Fuel Corp.'s Lawton C-4, 10-16-15, ste 6⅝-inch 2368 ft. J. J. O'Brien's Saxon 1, 16-16-16, cemented bottom of hole 2658 ft. Ohio Oil Co.'s Murphy 5, 9-16-15, sd 2736 ft; Pumphrey 1, 1-17-14, r 3096 ft. Owenwood Oil Corp.'s Goode 1, 31-16-13, dr 200 ft. Rovenger Oil Corp.'s Harrell 4, 15-17-16, dk. Richardson's Lawton 2, 10-16-15, fsh 2330 ft. Rice et al's Newton 1, 13-17-16, arr to deepen 2260 ft. Simms Oil Co.'s Ballard 1, 9-18-13, pulling casing 2673 ft. Skelly Oil Co.'s Roper 12, 3-16-15, arr to deepen (depth not known). Southern Crude Oil Purchasing Co.'s Wells A-5, 15-16-15, setting lead seal to case off sw at 2675 ft; Lyell B-7, 3-16-15, arr to deepen (depth not known). Smitherman & McDonald's Saxon B-4, 5-16-16, rig. Sun Oil Co.'s Hayes 3, 3-16-15, arr to blow with air 2275 ft. Stewart et al's Murphy 7, 9-16-15, perforating casing 2407 ft. Unity Pet. Co.'s Roper 15, 3-16-15, wosr 1978 ft. Wingfield et al's Greer 1, 15-19-13, sd 50 ft.

SOUTHERN CALIFORNIA

BOYLE HEIGHTS—Haskell M. Greene's 1, dr 2460 ft.

CLAREMONT—Claremont Oil & Gas Co.'s 1, sd 1130 ft.

DAVIDSON CITY—California Well Drilling Co.'s Del Amo 1, dr 6574 ft.

DOMINGUEZ — Dominguez Extension Oil Co.'s 1, sd 5510 ft.

DOWNEY—C. F. Acker's Downey 1, sd 270 ft.

EAGLE ROCK—Calwin Oil Co.'s 1, fsh for 4¾ cas, td 6138 ft.

EL SEGUNDO—Rider Syndicate's 1, sd 2300 ft. Southern Calif. Drilling Co.'s 1, sd 4865 ft.

GARDENA—Circle Oil & Gas Co.'s 1, sd 4130 ft.

HAWTHORNE—San Clemente Oil Co.'s Peck 1, dr 2125 ft.

HUNTINGTON BEACH—Calnan Pet. Co.'s S. & W. 1, dr 4160 ft. Petroleum Securities Co.'s Mills 1, dr 3180 ft.

INGLEWOOD—Alleson & Co.'s 1, sd 3200 ft.

MAYWOOD—Magnolia Pet. Synd.'s 1, sd 4450 ft.

MONTEREY—Monterey Park Pet. Co.'s 1, rig.

NEWHALL-SAUGUS—W. W. Stabler's Castaic 1, sd 3408 ft. Temple-Lefevre's Castaic 1, sd 2107 ft. Thomason & McCoy's 1, dr 1496 ft.

OLIVE—Standard Oil Co.'s C. B. 1, dr 2415 ft.

PLACENTIA—Shell Co.'s Allec 1, dr 2013 ft.

POTRERO—Associated Oil Co.'s Johnson 1, tested prod at 5507 ft, made some oil.

RIVERA—George F. Getty's Tubbs 1, dr at 4566 ft.

SAN FERNANDO—Shell Co.'s Mission 1, sr 3600 ft. W. O. Brubaker's Pacoima 1, sd 2690 ft.

SAN JOSE HILLS—The D. & B. Oil Co.'s 1, dr 4375 ft.

SAN JUAN CAPISTRANO—O. K. Carr's Forster 1, dr 2955 ft.

TELEGRAPH CANYON—Quadra Petroleum Co.'s MJM 1, sd 4210 ft.

WATTS—Southwest Pet. Corp.'s Ramsaur 1, dr 2410 ft.

WATSON—White-Behr Pet. Co.'s 1, rig.

YORBA—Petroleum Securities Co.'s Kramer 1, dr 560 ft. Standard Oil Co.'s Y. L. W. 1, dr 2463 ft.

RIVERSIDE COUNTY—Corona Oil & Gas Co.'s 1, sd 1550 ft. L. R. Clark's Cabazon 1, fsh for tools, td 150 ft. Hemet Pet. Corp.'s 1, dr 1285 ft. Spindletop Oil Synd.'s 1, sd 2750 ft. Trabuco Oil Co.'s 1, dr 2396 ft.

SAN BERNARDINO COUNTY—Colton Terrace Oil Co.'s 1, dr 1437 ft. Como Oil Co.'s Cajon 1, sd 2820 ft. Del Rosa Oil Co.'s 1-A, sd 915 ft. Hesperia Oil & Gas Co.'s 1-A, pulling tubing, td 3312 ft. H. & P. Oil Co.'s Ranger 1, sd 2150 ft. McCarthy & Collier's McCarthy 1, sd 1345 ft. Summitt Oil Co.'s 1, td 150 ft. Western Pacific Oil Co.'s 3, dr 2920 ft.

SAN DIEGO COUNTY—Cardiff Oil Corp.'s Turner 1, sd 2805 ft. Oceanside Oil Co.'s Dunn 1, sd 3210 ft. Southern Oil Co.'s Randall 1, sd 3210 ft. Southern Oil & Gas Co.'s Randall 1, dr 2310 ft. Torrey Pines Oil Co.'s 1, sd 480 ft.

NORTHERN CALIFORNIA

FRESNO COUNTY

CLOVIS—Fresno-Madero Oil Co.'s 1, 18-12-21, dr 3804 ft.

COALINGA—Potter-Esplin's 1, 6-16-14, rig.

RAISIN CITY—Fresno-United Oil Co.'s 1, 23-15-18, sd 3960 ft.

KINGS COUNTY

KETTLEMAN—Ahlburg Gasoline Corp.'s 1, 7-23-23, rig. Associated Oil Co.'s 1, 12-23-18, rig. Bolsa Chica Oil Co.'s 1, 30-23-19, dr 2926 ft. Chanslor-Canfield Midway Oil Co.'s 1, 17-24-19, pipe trouble 4700 ft. General Petroleum Corp.'s 1, 4-24-19, sr 1800 ft; 2, 22-26-18, 4046 ft. Milham Exploration Co.'s 1,2-22-17, pulling 15½ cas, td 3590 ft. South Coalinga Oil Co.'s 1, 35-24-19, dr 2570 ft.

KERN COUNTY

ANTELOPE PLAINS—W. H. Davis' 1, 13-26-17, dr 3090 ft.

BAKERSFIELD—Pacific-Eastern Production Co.'s Union Avenue 1, 6-30-28, kink in 8¼-inch cas, shut-in. George F. Getty's 1, 23-30-28, lcn.

BELRIDGE—Zurich Oil Co.'s 1, 18-28-22, water so failed 965 ft.

BUTTONWILLOW — Milham Exploration Co.'s Kern 1-A, 8-28-23, gas well, td 4660 ft; Salisbury 1, 7-29-24, cut 6¼ cas 3640 ft, td 2020 ft.

COMANCHE POINT—Kern 29 Oil Co.'s 1, 29-31-30, sd 2440 ft.

DELANO — Chanslor-Canfield Midway Oil Co.'s Quinn 1, 23-25-27, dr 2275 ft.

EDISON—Kerwin & Seale's 1, 4-30-29, rig. General Pet. Corp.'s 1, 5-30-29- lcn. George F. Getty's 1, 22-28-28, lcn.

DEVILS DEN—Devils Den Producing Co.'s 1, 23-25-18, pumping 11 barrels, td 1377 ft. W. T. Garrett's 1, 30-25-19, rig. Marathon Oil Co.'s 1, 13-25-18, sd 4390 ft. Midway Northern Oil Co.'s 1, 25-25-18, dr 2015 ft. Robbins Oil Co.'s 1, 25-25-18, sd 2280 ft. R. H. Sayers' 1, 25-25-18, sd 1500 ft.

GREENFIELD—Royal Petroleum Corp.'s 1, 31-30-28, rig.

GOULD HILLS—Bomke & Ball's 1, 12-29-20, dr 830 ft. California-Kentucky's 1, 8-29-21, co 1536 ft. Mendocino-Midway Oil Co.'s 1, 28-29-21, sd 2930 ft. Max L. Pray's 1, 1-29-20, will test at 865 ft, td 1214 ft. Rhoads Oil Co.'s 1, 20-29-21, sd 1485 ft. L. E. Westrich's 1, 19-29-21, sd 1755 ft.

McKITTRICK—Abbott Pet. Co.'s 1, 2-30-21, sd 1940 ft. Lacy-Esper Pet. Co.'s 1, 18-19-22, sd 3265 ft. McKittrick Hills Oil Co.'s 1, 18-30-22, plugged at 2500 ft, td 3250 ft. Ozena Oil Co.'s 1, 27-29-21, dr 1000 ft. Ridge Oil Co.'s 1, 13-20-21, co 4045 ft.

MON BLUFF—Miocene Oil Co.'s 1, 34-27-28, rig. Union Oil Co.'s 1, 28-27-28, lcn.

NORTH MIDWAY—Gore Oil Corp.'s 1, 34-30-22, sd 1350 ft. Electric Pet. Co.'s 1, 34-30-22, sd 400 ft. United Oil Co.'s 5, 6-31-23, dr 3665 ft.

SHALE HILLS—Huntington-Hawthorne Oil Co.'s 1, 35-26-18, sd 600 ft. Nelson & Mountford's 1, 18-27-19, sd 2690 ft. Oildale Oil Co.'s 1, 13-27-18, sd 550 ft.

SUNSET-FRESNO—Sunmaid Oil Co.'s 1, 20-11-24, sd 4200 ft. Raleigh Oil Co.'s 1, 8-11-23, dr 1846 ft.

TEMBLOR HILLS—Fortuna Oil Co.'s 1, 28-32-13, sd 2660 ft. Hovey Hills Co.'s 1, 19-31-22, sd 2540 ft. Painted Hills Oil Co.'s 1, 19-31-22, sd 500 ft.

TEHACHAPI-MOJAVE—C. R. Asmussen's 1, 23-11-11, sd 1510 ft. Crusaders Oil Co.'s 1,

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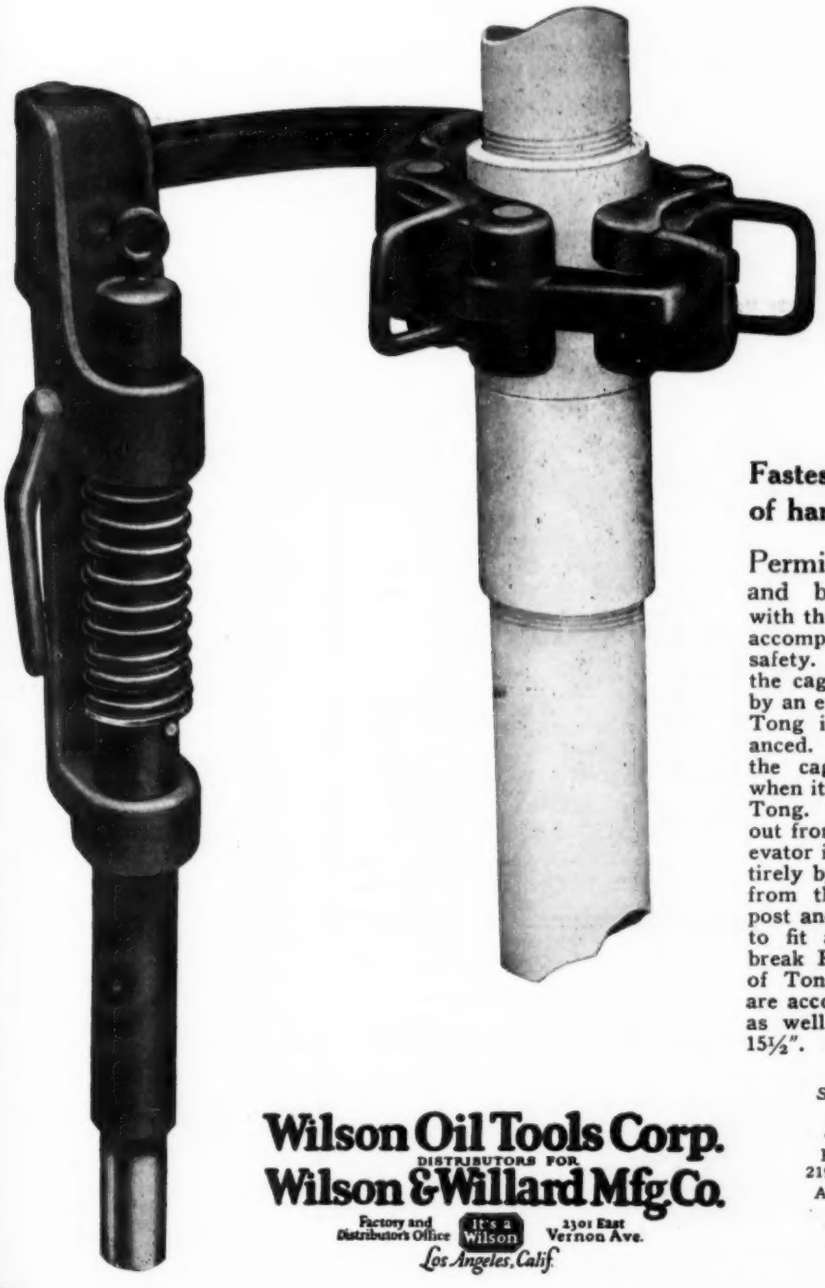

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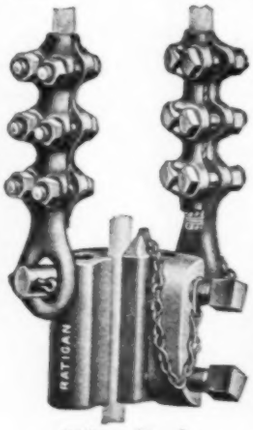

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21-10-10, re-cmt 2367 ft. John B. Harding's 1, 5-10-10, sd 1050 ft.

UPPER KERN RIVER—Wing & Skakel's 1, 34-28-28, sd 1050 ft.

UPPER POSO CREEK—H. L. Whiston's 1, 20-27-29, sd 925 ft.

VENTURA COUNTY

CAMARILLO—Standard Oil Co.'s Camarillo 1, failed to produce, td 5469 ft.

HOPPER CANYON — Bishop-Buckeye Oil Co.'s Union 2, sd 200 ft. Hopper Canyon Oil Co.'s 1, sd 5005 ft.

MONTALVO—Standard Oil Co.'s Montalvo 1, dr 6630 ft.

RINCON — Chanslor-Canfield Midway Oil Co.'s 1-A, testing for prod, td 6526 ft; 1B, failed to produce on test, td 4900 ft. Montecito Oil Producers' 1, 13-4-25, dr 3310 ft.

SOUTH MOUNTAIN — Ring Petroleum Corp.'s Converse 1, dr 3890 ft.

SULPHUR MOUNTAIN—Geiss & Bradford's 1, 21-4-22, dr 1893 ft. Ventura Crude Oil Co.'s 1, 23-4-22, lcn.

SQUAW FLATS—Border Oil Co.'s 1, co 675 ft.

VENTURA—Associated Oil Co.'s Dabney-Lloyd 1, fsh 5683 ft. Rio Grande Oil Co.'s Cannet 2, lcn. Star Petroleum Co.'s Canet 1, sdtr 3194 ft, td 5240 ft.

MISCELLANEOUS

GOLETA—Barnsdall Oil Co.'s Edwards 1, testing for production 2215 ft. Berry Oil Co.'s Cavaletto 1, fsh 2175 ft; Pomato 1, dr 1750 ft. California Eastern Oil Co.'s Dotty 1, dr 1745 ft. Graham-Loftus Oil Co.'s Orella 1, cmt 700 ft. A. T. Baker's La Patera 1, dr 300 ft.

MONTEREY COUNTY—Petroleum Securities Co.'s 1, 2-22-9, dr 2268 ft.

SAN DUIS OBISPO COUNTY — Arroyo Grande Pet. Co.'s 1, 21-32-13, sd 4386 ft. Barneyberg Oil Co.'s 1, 25-32-14, sd 4486 ft; 2, 25-32-14, dr 1257 ft. Paso Robles Oil Co.'s 1, 34-27-13, cmt 1410 ft. Waklin Pet. Co.'s 1, 27-27-11, re-dr 2310 ft.

SANTA BARBARA—Channell Oil & Development Co.'s 1, 22-4-26, dr 5151 ft. Hollywood Oil Corp.'s Sudden 1, sd 1300 ft.

SANTA YNEZ—San Marcos Oil Corp.'s 1, spd.

SAN MATEO COUNTY—Shell Co.'s Cowell 1, 8-6-5, dr 4135 ft.

SONOMA COUNTY—Shell Co.'s Murphy 1, 8-5-7, dr 5886 ft.

SUMMERLAND — Summerland Oil Co.'s Becker 1, dr 3050 ft.

TULARE COUNTY—Birch Oil Co.'s 1, 13-21-26, rig. Ducor Drilling Co.'s 1, 29-23-27, testing 4½ cas 3842 ft, td 4160 ft. Federal Exploration Co.'s 1, 15-22-24, sd 5460 ft.

MOUNTAIN STATES

UTAH

BOXELDER COUNTY—Lakeside Oil Co.'s 1, 31-9n-7w, waiting for cement to set 2630 ft.

CARBON COUNTY—Price River Pet.'s 1, 16-14s-10e, dr below 2290 ft. McGee & Holmes' 1, 14-15s-10e, fsh bit 1676 ft.

GRAND COUNTY—Embar Oil Co.'s Big Six 1, 34-25-21, small showing oil and gas 4070 ft. Crescent Dome Oil Co.'s sec 4-22s-19e, rig.

SAN JUAN COUNTY—Midwest Ref. Co.'s Hughes 1, 30-40-19, dr 3178 ft. Utah Pet. Co.'s Geohegan 1, 1-30-20, sd 1640 ft. Union of Calif.'s Lisbon 1, 16-30-25, showing in sand only 3 ft thick at 2565 ft. Francis Oil-Utah Pet.'s Francis 1, 36-41-17, sd 1900 ft. Boulder Knoll Oil & Gas Co.'s 1, 17-34-25, sd 1950 ft. Diamond Oil Co., sw 3-9s-4e, sd 2180 ft, waiting for parts.

SALT LAKE COUNTY—Tower Pet. Co.'s Salt Lake City, dr below 900 ft.

WASATCH COUNTY — Leonora Raddatz Synd.'s 1, 14-9-8, no report.

WASHINGTON COUNTY — Virgin Pet. Co.'s 1, 23-31s-12w, no report. Mid-American Oil Co.'s 1, 17-43s-15w, dr below 600 ft. Uzona Oil Co., 18-43s-15w, dr. Utah-Southern's Noble 1, 28-30-18, dr below 3250 ft; Canyon 1, 28-41-19, dr below 1300 ft.

WAYNE COUNTY—Texas Prod. Co.'s John L. Shipley 1, 5-27s-14e, filled back with rock to 175 ft, to straighten crooked hole.

MONTANA

CARBON COUNTY—Ohio Oil Co.'s Northern Pacific 1, 11-7s-21e, set 12½-inch 1740 ft.

LIBERTY COUNTY—Mid-Rocky Dev. Co.'s Federal Land Bank 1, nw 7-33n-7e, dr 1500 ft.

RICHLAND COUNTY—Community Drilling

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Here is the latest Lucey development in 16-inch Rotary Machines both in pipe screwing and standard types. Every oil man will welcome its unique advantages—a rotary especially adaptable for use with Portable Drilling Rigs and recommended for deep hole operations up to 3,000 feet.

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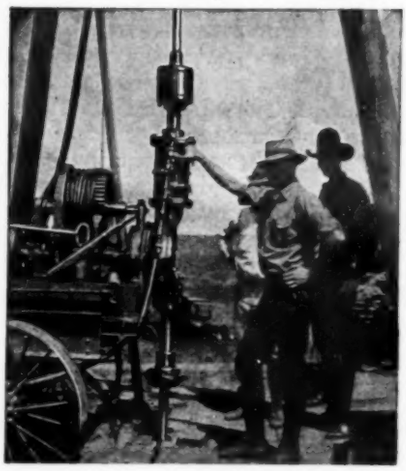

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MACHINERY COMPANY
419 Peoples Gas Bldg., Chicago
Dallas, Oklahoma, Tulsa, Garber, San Francisco

Co.'s Pioneer 1, Poplar Dome, rigging to drill deeper from 2600 ft.

TOOLE COUNTY—Kevin-Flathead Oil Co.'s Toole 1, ne 27-36n-23, sd, waiting on pipe at 1520 ft. Prairie Oil & Gas Co.'s Hunter 1, 13-33n-2e, abn 2089 ft. Zenith-McDonald's Lewey 1, 25-36n-1w, rig.

PONDERA COUNTY—Montana-Pacific Oil Co.'s 1, 32-28n-2w, dr below 1500 ft. Hiland-Van Daele's Kendale 1, ne 35-30n-3w, dr 3620 ft with 3000 ft water in the hole. Ute Moe's Denzer 1, ne 32-30n-2w, sd 3230 ft in Madison lime.

WYOMING

CARBON COUNTY—Graybeal Synd., 16-28-91, dr with hole full water, td 3850 ft. Pacific-American Oil Co., 31-25-91w, lcn.

CONVERSE COUNTY—A. A. Tylee, ne ne 8-32-72, rig. Criterion Oil Co.'s Irvine 1, 5-31-70, dr 3300 ft. John Ackard's McKinley 1, 21-31-69, dr below 2560 ft.

FREMONT COUNTY—Producers & Refiner's Muskrat 1, 34-34-92, ready to spd. Union of Calif.'s Maverick Springs 17, sw 15-6-2, dr 840 ft. Texas Prod. Co.'s Alkalie Butte structure, lcn. Zola Oil Co.'s Crook's Gap 1, twp 27, range 92, resuming operations shut down for one year.

HOT SPRINGS COUNTY—Union of Calif.'s Burnham 1-A, nw 28-43-91, abn at 2717 ft.

JOHNSON COUNTY — Carter Oil Co.'s Rider 2, se 17-48-82, fsh bit 3970 ft. Fairway Oil Co.'s Crazy Woman 1, 7-37-82, dr below 1800 ft.

NIOBRARA COUNTY — Hollingsworth Bros., se se 17-39-60, dr resumed 1700 ft. Buck Creek Oil Co.'s Ant Hills 1, 25-37-63, dr 3500 ft.

PARK COUNTY—Platte River Drilling Syndicate, sw sec. 12-26-67, cemented cave 2200 ft, to be able to fish tools 2300 ft. Union of California's Taylor 1, nw 22-47-101, skid rig.

SWEETWATER COUNTY—Jack Johnston's 1, sw 16-23-104w, dr 560 ft.

WASHAKIE COUNTY—Producers & Refiners Corp.'s Tensleep 1, 13-46-89, dr 1065 ft.

PLATTE COUNTY—Walter Adams' Trustee, 13-25-66, resumed 1650 ft, after having been sd for repairs.

NEW MEXICO

CURRY COUNTY—Hasson Pet. Co.'s Laird 1, 22-8-36, spd and sd. Frio Oil Co.'s Saunders 2, 11-5n-35, fsh 1230 ft. Steinberger et al's Hoskinson 1, 21-3-35, ur 1720 ft. Clovis Oil & Gas Co.'s Hoskinson 1, 21-3n-36, dr 2475 ft.

CHAVES COUNTY — Gibson Oil Corp.'s Forsyth 1, 8-11-23, sd 675 ft. Buffalo-Roswell 1, 24-11-27, reeling up new drilling line, td 4216 ft. Texas Prod. Co.'s Wilson 1, 29-17-18, dr 4150 ft. Sparrow & Drake's Fahrlander 1, 11-6-27, sd 60 ft.

COLFAX COUNTY—Chico Oil Co.'s Logan 1, 6-24-25, dr 800 ft.

DEBACA COUNTY—McAdoo Pet. Co.'s State 1, 16-1-27, dr 2624 ft. Trigg Synd.'s 1, 27-4n-22, sd 300 ft.

GUADALUPE COUNTY — Hanchett Oil Co.'s Rutherford 1, 24-8-24, dr 800 ft. Ike McNabb's McMullen 1, 24-5n-16, straightening crooked hole 225 ft.

McKINLEY COUNTY—Midwest Ref. Co.'s Hancock 1, 1-17-9, dr 2866 ft; No. 24, 2-17-9, sd 1836 ft; Hurst 1, 1-17-9, cemented 1610 ft. Pittsburg Dev. Co.'s 2, 29-20-10, bldg rig; 3, 19-17-9, lcn. Producers & Refiners Corp.'s 1, 25-13-9, abn 1857 ft. Smart & Reid, 7-17-9, bldg rig. Inland Oil Corp.'s 1, 22-18-10, cas set 460 ft. H. L. Williams' 1, 30-18-8, bottomed 1843 ft, water shut off, not test of oil. S. Dysart's 1, 21-14-9, ur, td 1172 ft, with oil showing. Continental Oil Co.'s Garcia 1, sw 9-17n-7w, dr 60 ft. Ohio Oil Co.'s Yontz 1, 18-16n-9w, sd 1380 ft, wtg for material. Reliance Oil Co.'s Hanchett 1, 15-17-9, dr below 522 ft.

QUAY COUNTY — Midwest Ref. Co.'s Rhodes 1, 30-18-31, sd 3650 ft. Gibson Oil Corp.'s 1, 25-8-32, contract completed to 3500 ft. Ohio Oil Co.'s Jordan Ridge 1, 24-7-29, sd, wtg cas 3530 ft.

TORRANCE COUNTY—San Juan O. & G. Co.'s Minerman 1, 32-7-10, wtg cas 2650 ft; Randall 2, 20-6-19, dr 4175 ft. F. G. Wilson Trustee's Pace 1, 12-6-7, sd 2013 ft.

SAN JUAN COUNTY—Portage Oil Co.'s No. 3, 25-31-13, set 8¼-inch 660 ft; Glade 1,

Ball retaining type washer keeps balls in place

BURNS

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The Burns Tubular Temper Screw is true economy; delivering constant service day after day, it has won the respect of drillers throughout the world.

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24-30-13, installing standard rig 2160 ft. Union Oil & Mining Co.'s Pine 2, 8-29-9, fsh. Kansas-Colorado Oil Co.'s Aterberry 1, 24-31-11, erecting standard rig, bottomed at 1350 ft. Senate Oil Co.'s Lanier 1, 34-29-11, erecting standard rig, td 1746 ft. San Juan Pet. Co.'s Palmer 1, standard rig, td 1295 ft. T. C. N. Oil Co.'s Lanier 1, 9-29-11, cement drilled out and gas increased, well shut in. Huntington Park Oil Co.'s 2, 29-30-9, ur, td 1800 ft. R. M. Smith's Abrams 2, 23-29-11, fsh 60 ft. Huerfano Oil Co.'s Wiltbank 1, 25-29-11, set cas 600 ft.

VALENCIA COUNTY — Acme Oil Co.'s New Mexico-Arizona Land Co., 26-6-3, dr 1965 ft.

UNION COUNTY—Sun State Pet. Co.'s Paso Monte 1, 14-24-30, sd 2977 ft.

EAST TEXAS

Completion

CHEROKEE COUNTY—

Company, Well and Location	Initial Production Bbls.	Depth
Humble, Reynolds Mortgage Co. 1, J. Durst sur	*	3774

ANDERSON COUNTY—Cosden Oil Co.'s Douglass 1, Issack sur, dr 2585 ft. Humble's Southern Pine 2-A, J. Morton sur, dr 4940 ft; Southern Pine B-1, H. Main sur, dr 4498 ft.

CAMP COUNTY—J. C. Rogers' Boyd 1, R. M. Montgomery sur, dk.

CHEROKEE COUNTY — Humble's Elliott 2, M. Windsor sur, lcn; Ragsdale 2, N. Johnson sur, coring 4464 ft; Reynolds Mortgage Co. 2, J. Durst sur, dk. Kirby Pet. Co.'s Commersession 1, Joseph E. Marques sur, arr to abn 4505 ft. Magnolia's Summers Est. 1, W. Brewer sur, arr to recement casing at 4330 ft. Panhandle Oil Co.'s Whalen 1, J. Jordan sur, dr 385 ft. Woodmanse Synd. Hall 2, J. Durst sur, sd 800 ft.

CASS COUNTY—Mid-Kansas Land 1, R. Potter sur, dr 2369 ft.

HENDERSON COUNTY—Cayton et al's Hoffer Nash 1, H. Jefferson sur, dr 1700 ft.

HARRISON COUNTY—Burk & Humphreys Waterman 1, Shires sur, set 6-inch at 2000 ft. J. R. Bahan's Epps 1, James Short sur, blow out at 980 ft. arr to skid over, td 2645 ft; Furrh 1, J. Short sur, lcn; Furrh 2, J. Short sur, dr 800 ft. Clark et al's Furrh 1, J. Short sur, testing 1948 ft. Magnolia's Anderson 1, J. Womack sur, lcn; Trosper 2, J. H. Harrison sur, dr 2590 ft. State Line O. & G. Co.'s Abney 4, E. Little sur, dk. C. H. Lyon's Bryson 2, T. D. Wilson sur, dr 1800 ft.

KAUFMAN COUNTY — Cranfield et al's Nicholson 1, A. Bennett sur, testing 3250 ft.

MARION COUNTY—J. D. Lynch's Stiles 2, N. Gupton sur, set 6-inch at 2000 ft.

NACOGDOCHES COUNTY—Stein & Lewis' Birdwell 1, Jose A. Chirino sur, sd 1100 ft.

PANOLA COUNTY—Magnolia's Lewis 5, James Johnson sur, sd 2000 ft; Lewis 6. B. C. Jordan sur, dk; Steele 10, B. C. Jordan sur, arr to set 8¼ at 2216 ft.

RUSK COUNTY — Magnolia's Durren 1, Agulla Norris sur, dk; Bradford 1, K. Ximenes sur, rig. McCurrie et al's Sparks 1, Jessee Coarse sur, r 1600 ft. Rusk Dev. Co.'s Matthews 1, Delores Cortinas sur, sd 2330 ft. The Texas Co.'s Schultz 1, A. Loffton sur, dr 670 ft.

SMITH COUNTY—Dr. Gathier's Parker 1, Don Thomas Quevedo sur, dr 1980 ft.

SHELBY COUNTY—Magnolia's Pickering 1, Wm. J. Crane sur, laying water line 2630 ft. W. M. Sebastian's Pickering 1, T. F. Polly sur, dr 2340 ft.

SABINE COUNTY—Carter Oil Co.'s Mills 2, Anthony Shoals sur, dr 2000 ft. Humble O. & R. Co.'s Temple 13, J. L. Quinnalty sur, dr 301 ft.

UPSHUR COUNTY — S. W. Richardson's Newsome et al 1, A. Butler sur, No. 81, sd 1900 ft.

WEST TEXAS

Completions

FISHER CONTY—		
F. P. Zoch & Marland Oil Co., Lanius 1	*	4367
JONES COUNTY—		
Manhattan Oil Co., King 1	*	2399
PECOS COUNTY—		
Moutray Oil Co., Robertson 1	*	54
REEVES COUNTY—		
Humble, T&P Fee 1-B	*	3887
TAYLOR COUNTY—		
Sanger O. & R. Co., Ike Brown 1	*	3510

ANDREWS COUNTY —Carter-Zweifel et al's Cowden 1, sd 3500 ft. J. S. Cosden et al's Bedford-Ratli¾ 1, spud and sd. Geo. Calvin & Belt's Bedford-Ratliff 1, spd and sd. Deep Rock Oil Co. and Sartain's W. J. Harris 1, elev 3168 ft, fsh 375 ft. C. B. McKennon et al's J. S. Means 1, sd 295 ft.

BREWSTER COUNTY—Van McPhail et al's McIntyre 1, dr 1000 ft. Wilcox & Anderson's Gage 1, dr 230 ft.

COKE COUNTY—W. H. Brown et al's W. L. Foster 1, spd and sd. Danciger O. & R. Co.'s Byrens 1, dr 810 ft. Lipan Oil Co.'s Conner 1, elev 2045 ft, sd 1215 ft.

CONCHO COUNTY—Associated Pet. Co.'s Sam Waring 1-A, dr 2385 ft. The Exploration Co.'s Wilson-Hartgrove 1, fsh 1930 ft.

CRANE COUNTY—Gulf's W. N. Waddell 2, elev 2744 ft, top salt 1170 ft, top gray lime 3095 ft, top oil pay 3221 ft, dr 3315 ft. Marland's Cordova Union Fee 1, fsh 230 ft.

CROCKETT COUNTY—Geo. H. Anderson-McKinley & Marland Co.'s University 1, dr 1080 ft. V. T. Bolin & Co.'s Coates 1, sd 2110 ft. Corbett & Gill's Todd 1, rig; University 1, rig. W. W. Donnelly & J. D. Young's Pierce 1, elev 2105 ft, sd 1380 ft; Shannon 1, spd and sd. Epenauer et als' Nolke 1, spd and sd. Gulf Prod. Co.'s Powell 2-D, dr 665 ft; G. L. Thompson 1, dr 85 ft. Geo. A. Henshaw Jr. & Co.'s Noelke-Murphy 1, rig. J. K. Hughes Dev. Co.'s Powell 2-B, ur cas 2535 ft. Humble & Marland's Powell 3-B, top salt 1050 ft, dr 1860 ft. J. F. McMannon Oil Co.'s J. B. Blakeney 1, machine. Newman Oil Co.'s B. C. Clark 1, lcn. Wm. Schaffer et al's University 2, elev 2666 ft, top salt 1060 ft, top lime 2088 ft, showing oil 2190-96 ft. Taylor-Link Oil Co.'s Powell 1, top salt 1050 ft, dr 1405 ft. P. H. Williams et als' Powell 2, dr 840 ft.

CULBERSON COUNTY—Gardner et al's Radford 1, sd 541 ft. Scott & Dittman's Miller 1, spd and sd.

JEFF DAVIS COUNTY — Humble's C. Flores 1-A, rig.

DAWSON COUNTY—R. R. Penn's G. C. Wright 1, elev 2842 ft, top salt 1750 ft, cem 8¼ cas and stdz 2449 ft.

ECTOR COUNTY—J. S. Cosden & The Texas Co.'s Connell 2-A, sd 3515 ft; Connell 3-A, sd 3545 ft.

FISHER COUNTY—Ideal Oil Co.'s Jameson 1, sd 3304 ft. Marland & Miley Oil Corp.'s W. W. Ammons 1, hfw 3015-35 ft, set 6⅝ cas 3110 ft. Sinclair's Farmer-Denise 1, dr 2495 ft. R. W. Rainey et al's Marberry 2, sd hfw 2725 ft. The Texas Co.'s Stephens 1, probably junked hole 2302 ft.

GAINES COUNTY—Westheimer & Daube's Forbes 1, cem cas and stdz 3900 ft.

GARZA COUNTY—Emerald Oil Co.'s Boren 1, sd 2600 ft. Pandem Oil Corp.'s Justice 1, elev 2262 ft, top salt 585 ft, top lime 1810 ft, trace oil 2140 ft, dr 2170 ft.

GLASSCOCK COUNTY — The California Co.'s W. B. Currie 1, elev 2694 ft, dr 925 ft. Frank M. Greene Corp.'s Oxshear 1, elev 2540 ft, top salt 1245 ft, dr anhydrite 2270 ft. Landreth Prod. Corp.'s Houston 1, elev 2611 ft, top salt 1410 ft, sd 2620 ft. Magnolia Pet. Co.'s Roberts 1, rig. World Oil Co. et al's MacDowell 1, elev 2545 ft, top salt 1180 ft, dr 2855 ft.

TOM GREENE COUNTY—Fitzgerald & Taliaferro's Bennett 1, dr 925 ft. Marland Oil Co.'s Llano Fee 1, hfw 3490-95 ft, dr 3512 ft. L. N. Nickey-Dullahan et al's Jacobs 1, sd 630 ft. Tulsa Oil Co.'s Adams 1, sd 735 ft.

HOCKLEY COUNTY—World Oil Co.'s Ellwood 1, rig.

HOWARD COUNTY—Bowers et al's Jones 1, elev 2218 ft, sd 500 ft. The California Co.'s Fisher 1, rig. Fred Carey et al's Chalk 2, sd 1040 ft. W. W. Donnelly & Mann's Martin 1, elev 2552 ft, top salt 960 ft, sd 2200 ft. F-H-E Oil et al's Roberts 1-B, testing oil pay 1820-35 ft. L. C. Harrison et al's Roberts 2, dr 160 ft. Geo. A. Henshaw Jr. and Co.'s Eason-Settles 1, set cas 1340 ft. Magnolia's Mary Chalk 6, ur 635 ft; Mary Chalk 7, cas trouble 920 ft; Kelly-Chalk 5, bailed 2 bbls oil 1265 ft; Kelly-Chalk 6, set 8¼ cas 848 ft; Sarah-Hyman 5, dr 455 ft. Marland Oil Co.'s Clay 1-E, dr 575 ft; Jones 1, elev 2218 ft, sd 500 ft; A. M. Fisher 1, elev 2740 ft, sd 1500 ft; A. G. Haines 1, rig. Marland & Texon Oil & Land Co.'s Quinn 1, top salt 1190 ft, dr 1205 ft; Guitar 1-A, rig; Connally 1, lcn; W. R. Settles 2, dr 775 ft. Peer Oil Corp.'s C. D. Read 1, rig. Vitex Oil Co.'s Clay 1, dr 860 ft.

HUDSPETH COUNTY—Lockhart & Co.'s Gardner-Moseley 1, sd 220 ft.

JONES COUNTY—E. P. Campbell & White Eagle O. & R. Co.'s Herndon-Poor 1, sd 3009 ft. Cole-Hart et al's Joe Dillard 1, lcn. Gillette & Hickey's M. E. Young 1, dr 1830 ft. R. F. Garland & Co.'s Glynn 1, dr 1820 ft. Hutson & Weaver's Smith 1-A, dr 610 ft. Kirk &Brewer's J. N. Milsap 1, re-set 6⅝ cas 2910 ft. Marsten Oil Co.'s Howell 1, sd 2545 ft; Swan 1, sd 3503 ft. W. G. Stough et al's Willis 1, dr 1540 ft. Stebbins Oil & Gasoline Co.'s Higgs 2, lcn; Scott 1, lcn. Swensondale Oil Co.'s Canton 1, dr 2410 ft. J. L. Tomberlin et al's Clapp 1, cavey hole 2085 ft.

KENT COUNTY—Douglas Oil Co.'s Scoggins 1, dr 4325 ft.

KING COUNTY—Gibson-Johnson et al's Burnett 1, elev 1715 ft, dr 3175 ft. The California Co.'s Spikes 1, elev 1719 ft, dr 2560 ft. Humble's Pitchfork 1, rig. Mid-West Explo. Co.'s Patton 1, elev 1706 ft, ur 2843 ft. Sinclair O. & G. Co.'s Burnett 1, elev 1804 ft, dr 3265 ft. Pattison et al's Patton 1, elev 1616 ft, sd 2232 ft. White Eagle O. & R. Co.'s Burnett 1, elev 1818 ft, sd 2990 ft.

LOVING COUNTY—Kingwood Oil Co.'s Moore 1, elev 3120 ft, top salt 1210 ft, dr 3250 ft. Owen-Sloan et al's Johnson 1, elev 2934 ft, sd 930 ft.

MIDLAND COUNTY — Orbit Oil Co.'s Moreland 1, sd 150 ft.

MITCHELL COUNTY—Magnolia's McKinney 1, dr 4160 ft. Thraves Oil Corp.'s C. Way 1, dr 2475 ft. Thraves & Tex-O-Kan Oil Co.'s W. F. Sanders 1, dr 2560 ft.

NOLAN COUNTY—Phillips' Scott 1, sd repairs 3732 ft. John Winemiller Corp.'s Booth 1, co 1835 ft. Henry Zweifel et al's Neal-Longbatham 1, ur 2485 ft.

PECOS COUNTY—Allsman-Bell et al's Pecos River Bed 2, elev 2155 ft, top salt 400 ft, dr anhydrite 1480 ft. Geo. Anderson et al's Sherbino 1, lcn. Buell-Hagan et al's Batchelor 1, elev 3136 ft, fsh 2740 ft; Jasper 1, elev 3307 ft, fsh 510 ft. The California Co.'s M. A. Smith 1, standard rig; Yates 2, rig. Diamond Pet. Co.'s Blackstone-Slaughter 1, lcn. T. R. Cowell et al's J. C. Trees 1, elev 2545 ft, top salt 2305 ft, sd 3335 ft. M. C. Dibble et al's Bonebrake 1, sd 500 ft. Bob Elmore et al's Manly Holmes 1, elev 2176 ft, top salt 335 ft, dr 1150 ft. R. F. Garland & Co.'s El Paso Fee 1, elev 3264 ft, top lime 1950 ft, dr 2155 ft. Gulf's M. A. Smith 1, set 12½ cas 395 ft. Henshaw Jr. & Co.'s Schimmel 1, lcn. Humble O. & R. Co.'s M. A. Smith 1, dk. Marland Oil Co.'s I. G. Yates 1-A, elev 2172 ft, making gas dr 925 ft. McMan & Marland's Yates 2, lcn. Mazda Oil Co. et al's Smith 1, elev 2706 ft, testing oil pay 1468-72 ft. Mid-Kansas & Transcontinental's M. A. Smith 1, lcn; Smith-Taylor 2, machine; I. G. Yates 7-A, making 2 mil ft gas 1200 ft; Yates 8-A, machine; Yates 3-B, elev 2152 ft, flowing 8 bbls hourly 888 ft; Yates 4-B, lcn; Yates 1-D, lcn. Red Bank Oil Co.'s McKenzie 1, elev 3279 ft, dr hfw 2675 ft. W. R. Shankel et al's Yates 1, elev 2190 ft, top salt 425 ft, sd 1470 ft. Simms Oil Co.'s M. A. Smith 1, rig; Devlin 2, lcn. Texon Oil & Land Co.'s Yates 2, sd 1754 ft. Transcontinental Oil Co.'s Blackstone-Slaughter 1, rig.

PRESIDIO COUNTY — Hadlock-Miller et al's Tootle 1, elev 2912 ft, sd 2770 ft. Pinto Canyon Oil Co.'s Field 1, lcn.

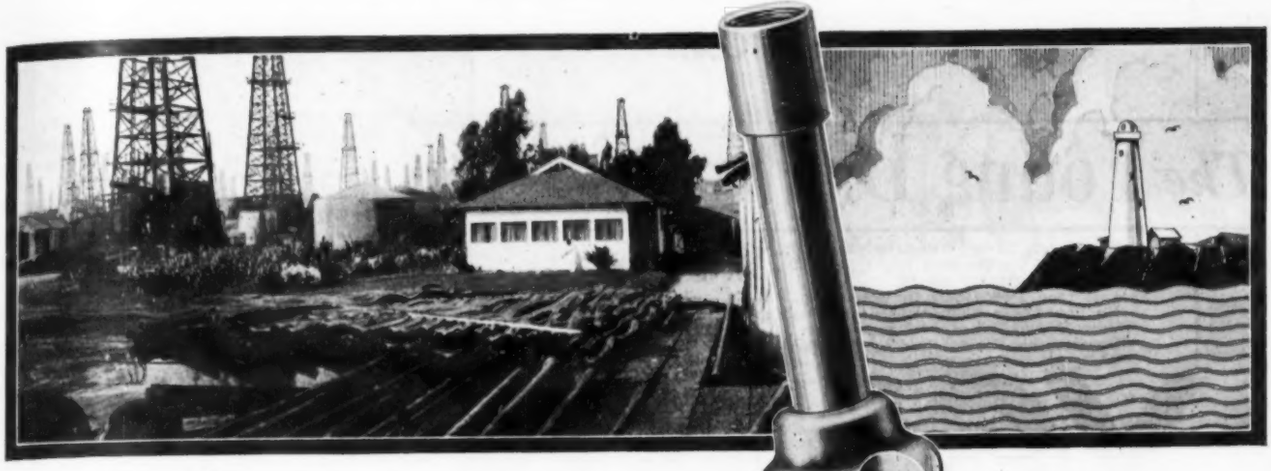
REGAN COUNTY—H. D. Camp et al's University 1, rig. Texon Oil & Land Co.'s University 1-B, elev 2733½ ft, top salt 1110 ft, top lime 2780 ft, sd for electric motor with 3500 ft oih 6284-6573 ft.

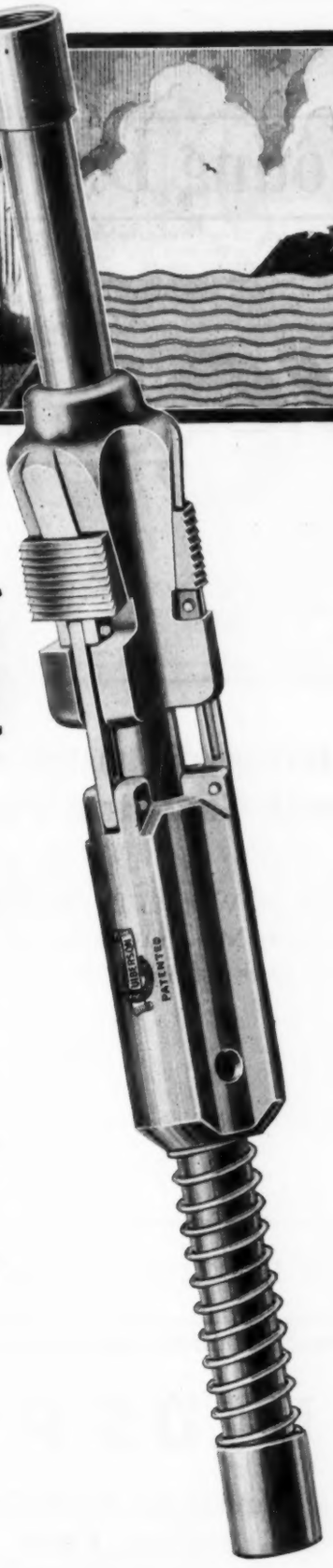
REEVES COUNTY—The Exploration Co.'s Kinnney 1, elev 2847 ft, spd and sd. D. R. Thompson et al's A. A. Eddins 1, dr 205 ft. World Oil Co.'s Du¾ 1-A, elev 2753 ft, top salt 1940 ft, fsh tools with good show oil 3655 ft; Biggs-Holder 1-A, elev 3058 ft, sd 1610 ft.

RUNNELS COUNTY—Noble O. & G. Co.'s Simms 1, co 1675 ft.

SCHLEICHER COUNTY—Thos. Gray et al's Robinson 1, ur 8¼ cas 2200 ft.

STERLING COUNTY—Bill Little et al's Fisher 1, co 1435 ft. G. B. Orr et al's N. Read





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Seneca Falls, New York

1, dr 895 ft. P. H. Williams et al's Clark 3, dr 755 ft.

STONEWALL COUNTY—R. F. Garland & Co.'s Ward 1, sd 2980 ft. Peer Oil Corp. & Producers Oil Co.'s R. P. Morrow 1, ur 10-inch cas 1190 ft.

TAYLOR COUNTY — Brown Producing Co.'s Henslee 1-A, elev 2010 ft, set 10-inch cas 1460 ft. Dorning & Perrine's Hammer 1, sd 455 ft. Halbert et al's Hunt 1, dr 2975 ft. Gilbert Johnson et al's Brown 1, spd and sd. Morrison & Thompson's Rose 1, sd 2539 ft. Owen-Sloan et al's Latimer 1, ur 2465 ft. Roesser-Pendleton Inc.'s Sam Butman 1, ur 10-inch cas 1080 ft. World Oil Co.'s Griffith 1, testing oil pay 3510-12 ft.

TERRY COUNTY—Kingsland Oil & Potash Co.'s Brownfield 1, sd 2200 ft.

UPTON COUNTY—J. M. Hickey et al's Gormley 1, dr 275 ft. Marland & Levi Smith's University 1, elev 2672 ft, top salt 1275 ft, top lime 3195 ft, dr 3210 ft. Wise & Jackson's J. H. Porter 1, elev 2589 ft, top salt 1370 ft, dr 2525 ft.

VAL VERDE COUNTY—Douglas Oil Co.'s Sellars 1, dr 3005 ft. Magnolia Pet. Co.'s Whitehead 1, dr 2345 ft. S. A. McCaskey's Sellars 1, dr 3180 ft. O. O. Owens et al's Henry Mills 1, elev 2130 ft, making one-half million ft gas, dr 2655 ft. E. T. Williams et al's Holman-McNutt 1, sd 2940 ft.

WINKLER COUNTY—Amerada's J. B. Walton 1, lcn. Atlantic Oil Prod. Co.'s Grisham-Hunter 1, elev 2814 ft, top salt 1510 ft, top lime 2458 ft, sd 2522 ft; Ida Hendricks 1, lcn. Arizona Mining & Eng. Co.'s Hendricks 1, lcn. V. T. Bolin & Co.'s Hendricks 1, lcn. Cranfill Bros. Oil Co.'s M. J. Bashara 1, lcn. Cranfill & Reynolds' Ida Hendricks 1, rotary rig. Gulf's Hendricks 2, rig; Hendricks 3, elev 2818 ft, top salt 1825 ft, fsh 2358 ft; Hendricks 4, elev 2818 ft, top salt 1885 ft, top lime 2562 ft, cem 5-inch cas and sd 2569 ft; Hendricks 5, elev 2821 ft, salt at 1590-2070 ft, top lime 2443 ft, sd 2505 ft; Hendricks 6, elev 2825 ft, top salt 1575 ft, top lime 2374 ft, sd 2556 ft; Hendricks 7, elev 2826 ft, top salt 1700 ft, top lime 2476 ft, sd 2520 ft. Ed. S. Hill-Ladd & Tidal Oil Co.'s Ambrugey 1, co 3447 ft. Humble O. & R. Co.'s Grisham-Hunter 1, top salt 1480 ft, dr 2645 ft; Grisham-Hunter 2, spd and sd; Hendricks 1, elev 2823 ft, fsh 1920 ft. Independent O. & G. Co.'s Grisham-Hunter 1, elev 2816 ft, top salt 1785 ft, sd 2595 ft; Grisham-Hunter 2, elev 2822 ft, ur 8¼ cas 1565 ft; Hendricks 1-B, (Sec. 44) lcn. Landreth Prod. Corp.'s Grisham-Hunter 1, rotary rig; Grisham-Hunter 2, lcn. Llano & Roxana's Scarborough 1, elev 2943 ft, top salt 1115 ft, plug back from 3447 ft to 3347 ft, sd for shot. McCulloch Oil Co. Marland Oil Co.'s Tobe Morton 1, Elev. 2750 ft, top salt 2110 ft, dr 2725 ft. R. S. Matthews et al's Cowden 1-A, Elev. 2750 ft, top salt 1623 ft, dr 2150 ft. Murchison-Cranfill & Marland Oil Co.'s Grisham-Hunter 1, Elev. 2807 ft, top salt 1387 ft, top lime 2285 ft, cem 6-inch casing 2355 ft, making 8 million ft gas 2425 ft. Pure's Grisham-Hunter's 2, Elev. 2823 ft, top salt 1518 ft, top lime 2388 ft, co 2479 ft; Grisham-Hunter 1-B, Elev. 2827 ft, dr 315 ft. Republic's Grisham-Hunter 1-A, lcn. Roxana Pet. Corp.'s Grisham-Hunter 1-A, dk. Southern Crude Oil Purchasing Co. & R. A. Westbrook & Co.'s Hendricks 1-A, (Sec. 44) Elev. 2845 ft, top salt 1907 ft; top lime 2630 ft, flowed 780 bbls oil, dr 3018 ft; Hendricks 1-B, (Sec. 4) Elev. 2784 ft, top salt 1720 ft, top lime 2616 ft, cem cas 2602 ft; Grisham-Hunter 1-A, (Sec. 35) Elev. 2817 ft, top salt 1219 ft, dr 1450 ft. Southern's Hendricks 3-C, Elev. 2816 ft, top salt 1870 ft, top lime 2630 ft, sd 2735 ft; Hendricks 4-C, Elev. 2814 ft, top salt 1913 ft, top lime 2600 ft, sd making oil and gas 2740 ft; Hendricks 1-F, (Sec. 33) Elev. 2817 ft, sd 2529 ft; Hendricks 3-A-T-67, cem 10-inch cas 209 ft; Hendricks 3-A-T-68, rotary rig; Hendricks 1-B-T-67, cem 10-inch 225 ft. Texon Oil & Land Co.'s Grisham-Hunter 1, Elev. 2824 ft, top salt 1610 ft, top lime 2320 ft, spraying oil with heavy gas flow 2810 ft; Grisham-Hunter 1-B, dk; Grisham-Hunter 2-B, lcn. White Eagle O. & R. Co.'s Leck-Collins 1, Elev. 2830 ft, swedg cas 1875 ft.

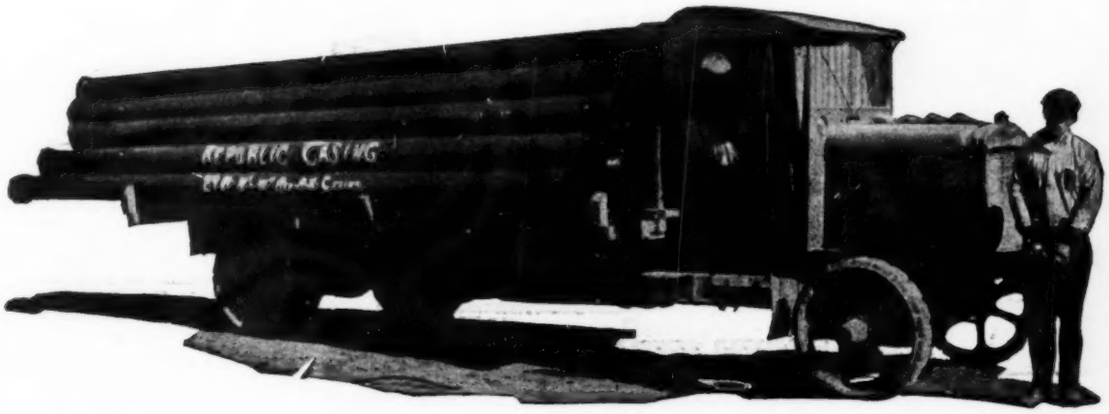
SOUTHWEST TEXAS

Completions

Maddox et al, Bruni 1..... • 2518
Houston Oil Co., Bruni 1..... • 2591

BROOKS COUNTY—The Texas Co.'s Lasater 3, dr 2796 ft, hard sand.

REPUBLIC



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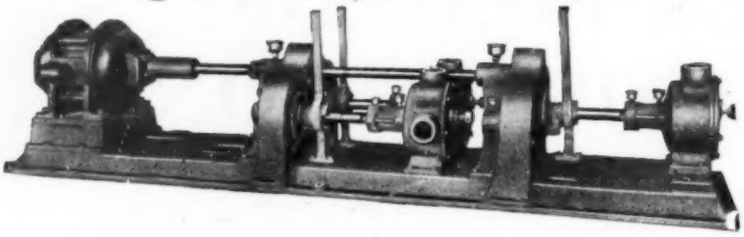

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HIDALGO COUNTY—Queen City O. & G. Co.'s Amer. Land & Irrig. Co. 1, n Mercedes, dr 2043 ft, shale and gumbo. Dale Smith's Daskan 1, T. abn 2107 ft.

MAVERICK COUNTY—Rycade's Sullivan 1, dr 4605 ft, gray lime; Chittam 1, fsh 5630 ft; Chittam 2, ru. Johnson et al's Wipff 1, dr 1365 ft, blue shale. Ryan Consolidated's India Land Co. 1, 24 mi se Eagle Pass, dr 1804 ft, shale.

SAN PATRICIO COUNTY—Davis-Picket et al's Cage 1, White Point, dr 1300 ft, gumbo. Mission Drilling Co.'s Cage 1, White Point, set 6⅝ cas 2310 ft. Houston Oil Co.'s Ragsdale 1, lcn. Houston Oil Co. & Sun's Steele 1, dr 938 ft, gumbo.

STARR COUNTY—F. G. Folz's Salinas 1, re-bldg dk.

VAL VERDE COUNTY—East Del Rio's Weatherbee 1, rigging up gas engine, td 3182 ft. Owens et al's Mills 1, dr 2624 ft, black sandy and lime shale. Williams et al's Holman 1, sd 2940 ft. Douglas et al's Sellars 1, sd 3010 ft. Benedum Trees, Sellars 1, dr 3160 ft, grey lime. Independent Operator's Whitehead 1, to resume dr at 3900 ft. Magnolia's Whitehead 1, dr 2268 ft, hard lime.

TEXAS GULF COAST

Company, Well and Location	Initial Production Bbls.	Depth
MATAGORDA COUNTY—		
Danscinger et al, Bowie 1.....	*	2006
JEFFERSON COUNTY—		
Texas Co., Garrick 1	*	6028

AUSTIN COUNTY—Humble's Gotoskey 1, Raccoon Bend, rigging up.

BRAZORIA COUNTY—Roxana's Pabst 2-A, Clemens Dome, dr 6134 ft, shale and shell; Allen Bernard River 1, Allen Dome, dr 4616 ft, shale and lime; Allen 4, Allen Dome, dr 4539 ft, sandy lime; Randon 1, Allen Dome, wtg on orders. Danscinger Oil Co.'s Bartlett 1, 3 mi w of West Columbia, lcn. Pure-Humphreys' Armstrong 1, Stratton Ridge, dr broken sand 4357 ft, no show. Associated Oil Co.'s Seaburn 1, Stratton Ridge, dr 4155 ft. Gulf's Perry 2, Stratton Ridge, dr 3502 ft, oil sand, slight show.

FORT BEND COUNTY—Gulf's Trout 4, Long Point, dr 871 ft, hard sand. Sun's Kisparek 1, dr 510 ft, shale and lime. Gulf's Wolf 4, Long Point, lcn 300 ft nw of No. 2 and in line with No. 1 and 2; Farmer 3, Boling, cored shale, lignite, pyrites, odor oil and sulphur, 2601 ft; Beard 1-A, Long Point, dr 703 ft, gumbo.

HARRIS COUNTY—Dr. P. S. Griffith's Fee 2, 12 mi n of Houston, sd. Juanita Oil Co.'s Kitsman 1, 2 mi no of Cypress, sd. Humble-Marland's Warren 1, Hockley coring sand 3820 ft.

JEFFERSON COUNTY—Gulf's Bordages 3, Fannet, dr 6262 ft, sandy shale. The Texas Co.'s Garrick 1, one-half mile n Spindle Top, abn 6028 ft, sticky shale. Houston Oil Co.'s Fitzhugh 2, Big Hill, dr 4955 ft, sandy shale and lime. Beaumont Oil & Prospecting Co.'s Terrel 1, 3 miles nw Beaumont, td 2495 ft, sd for water. J. O. Davis et al's Gladys 1, Spindle Top, dr 3380 ft, shale. South Spindle Top O. & D. Co.'s Young 1, 1 mile w Nederland, dr 1297 ft, gumbo.

LIBERTY COUNTY—Harrison Oil Co.'s Quintette 2, lcn. Judge Titwell et al's Gardner 1, 5 miles e Davis Hill, dr 1385 ft, gumbo and shale.

MATAGORDA COUNTY—Gulf's Sanborn 3, Hawkinsville, dr 4380 ft, hard sand and lime. Matagorda County Dev. Co.'s Hawkins 1, Bay City, dr 1270 ft, gumbo. Rycade & Houston Gulf Gas oC.'s Sisk 2, Markham, dr 1357 ft. Danscinger et al's Bowie 1, Cedar Lane, abn 2006 ft.

MONTGOMERY COUNTY—Brain et al's Fitch A-1, 3 miles e of Spring, was Fitch 1, moved dk 18 ft n and making new hole, dr 1800 ft, shale, lime and gumbo. Beard et al's Beard 1, 15 miles e of Conroe, sd 1210 ft.

WHARTON COUNTY—Ingram Prospecting Co.'s Mensing 1, Boling, sd.

SOUTH LOUISIANA

	Completions	
ACADIA PARISH—		
Cline-Smith-Cline, Wilson 2	30	....
CALCASIEU PARISH—		
Union Sulphur Co., Fee 720	*	4779

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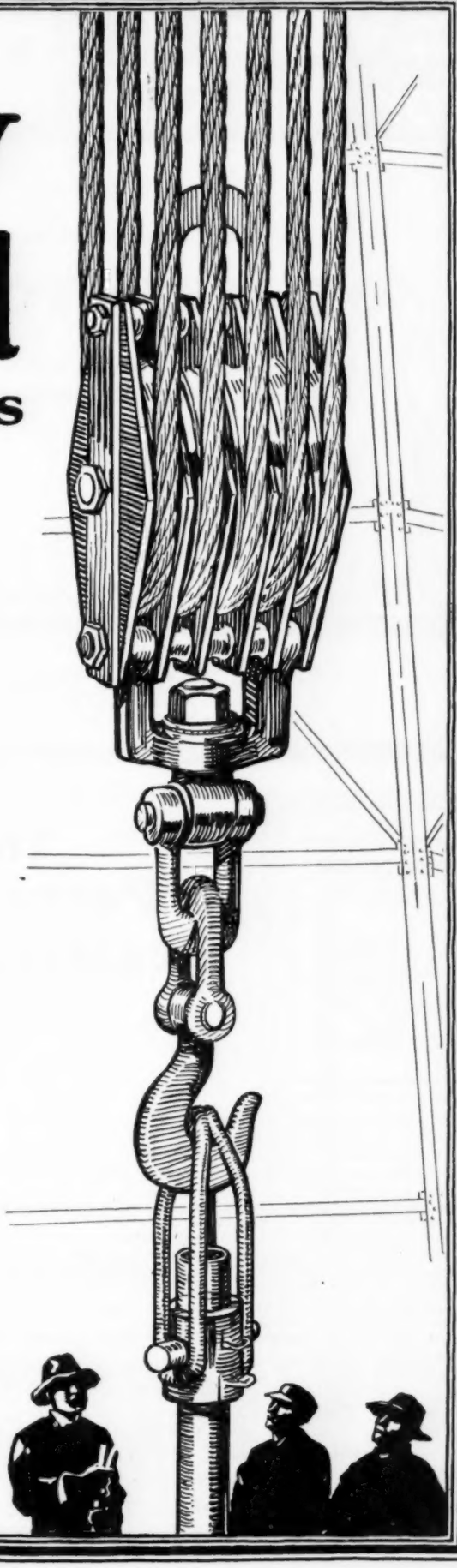

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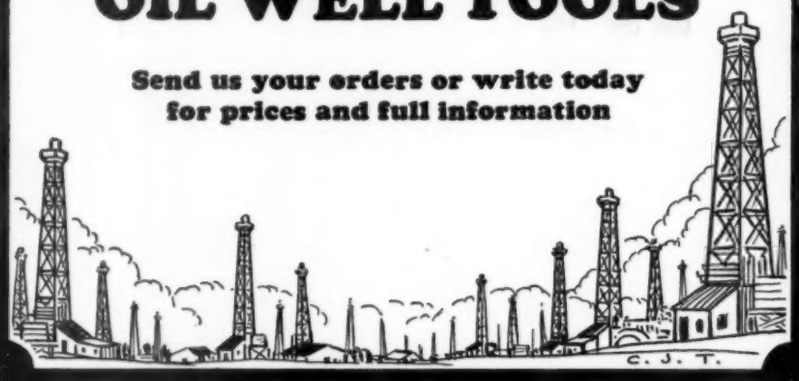

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PETROLEUM REGISTER

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La. Land & Expl. Co., Calcasieu Lake 1 . . . . . * 4309

ACADIA PARISH—Yount-Lee's Houssiere-Latrielle 1, Jennings, coring water sand. Gulf's Lekelt et al 1-C, Jennings, prep to dr deeper from 1660 ft. Cline-Smith-Cline's Wilson 2, Jennings, pumping 30 barrels oil.

ASCENSION PARISH—Gulf's United Lands Co. 2, Sorrento Dome, dr 1726 ft, cap rock.

CALCASIEU PARISH—Union Sulphur Co.'s Fee 720, Sulphur Mines, abn. Dr. Hintze's Beckenstein 1, Sulphur Dome, sd 4260 ft. Louiana Land & Exploration Co.'s Calcasieu Lake 1, abn. Union Sulphur Co.'s Fee 721, Lake Charles, ru. Newton Dev. Co.'s Dupre 1, Lake Charles, sd 963 ft. Wilson & Broach's Wilson 4, Edgerly, dr 728 ft, sand.

CAMERON PARISH—Pure's Sweet Lake 4, Sweet Lake, dr 5143 ft, sand showing oil and gas; Sweet lake 5, Sweet Lake, will dr deeper from 4506 ft. Yount-Lee's State Black Lake 4, Hackberry, abn. Calcasieu Oil Co.'s Caldwell 1, Hackberry, sand showing oil, 4003 ft, will bail open hole. La. Land & Expl. Co.'s Mallard Bay 1, dr 3512 ft, sand; Sabine Lake 1, sd 3335 ft.

JEFF DAVIS PARISH—Estropal Oil Co.'s LeDoux 2, sd. John Carrodine's Walsh 1, Welsh, ru.

IBERIA PARISH—Gulf's State Z-2, Eagle Point, no report. Calcasieu Oil Co.'s Schwing A-1, Eagle Point, no report. La. Land & Expl. Co.'s Vermillion Bay 1, dr 3027 ft, blue gumbo.

LA FOURCHE PARISH — Gulf's Dibert-Stark-Brown 1, Thibodaux, ru.

ST. MARY PARISH — La. Land & Expl. Co.'s Grand Lake 1, dr 4519 ft, sand and gumbo; West Cote Blanche 1, prep to resume.

ST. MARTIN'S PARISH—Rycade's Atchafalya 1, sd.

COMPLETIONS

(Continued from page 124)

MOUNTAIN STATES

NEW MEXICO

McKINLEY COUNTY—
Midwest Ref. Co., No. 34, sw 36-18-9 . . . . . 50 1612

SAN JUAN COUNTY—
Mid-Continent Oil Co., Ransom 1, 22-29-11 . . . . . 10 987

MONTANA

KEVIN-SUNBURST—
Homestake Explo. Corp., Howling 5, ne 9-35-2w 50 1300
Reibe 10, ne 4-45-2w . . . . . 15 ....
State 35, ne 36-35-2w 25 1320
Big West Oil Co., Allen 25, se 31-35-1w 800 1433
Dakota-Montana Oil Co., Wlicox 3, ne 7-34-1w 750 1388
Wilcox 4, nw 8-34-1w . . . . . ¶1 1165
General Oil Co., Hagerty 1, sw 13-35-2w . . . . . ¶1 ....
Northern Nat. Gas Dev. Co., McAdoo 1, se 14-32-2w . . . . . ¶8 1564
McLean 1, ne 6-32-1w . . . . . ¶4 1286
Schnail 1, se 3-32-2w . . . . . ¶3 1511
Ohio Oil Co., Kenny 1, 15-35-2w... 10 1546

WYOMING

GARLAND ANTICLINE—
Ohio Oil Co., Cross Gas Co. 2, 33-56-99 . . . . . ¶40 3163

CALIFORNIA

BALDWIN HILLS-INGLEWOOD—
Standard, Baldwin-Cinega 53 . . . . . 300 2000

BREA-OLINDA—
Shell Co., Orange 15 . . . . . 650 5225

HUNTINGTON BEACH—
Standard, Electric 9 . . . . . 370 4329
Electric 10 . . . . . 400 4350
Globe Lease & Royalty Co., No. 2.. 100 4347

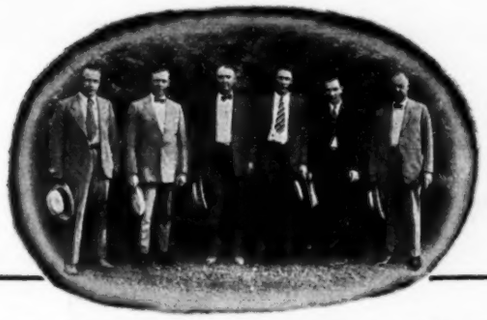
KERN FRONT—
Chanslor-Canfield Midway Oil Co., No. 6, 23-28-27 . . . . . 200 2296
George F. Getty, Lenhart 22 . . . . . 150 2090

MIDWAY—
Standard, 28, 31-31-24 . . . . . 130 3795
29, 31-31-24 . . . . . 115 3870

RICHFIELD—
California Pet. Corp., Consolidated 15 . . . . . 75 2911

SEAL BEACH—
California Eastern Oil Co., Parr 1 ..2000 4925
Associated Oil Co., Hellman 4.....2000 4613

VENTURA—
Shell Co., Gosnell 23 . . . . . 1000 6315



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August 26, 1926

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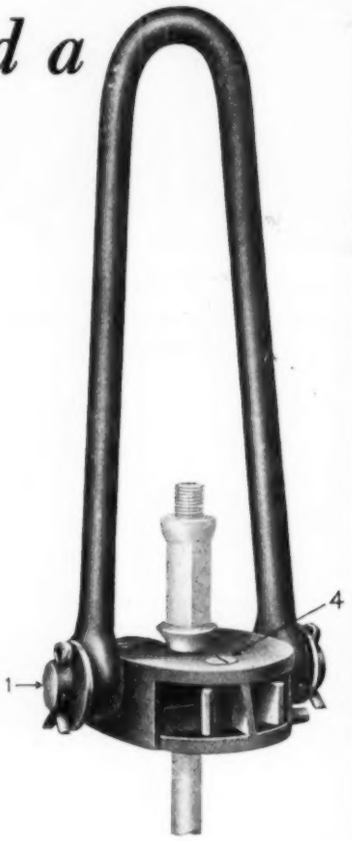

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Bannatyne Structure to Get Thorough Test

Great Falls, Mont.—Pumping test on Bannatyne structure, 46 miles north of the City of Great Falls, shows an initial production at the Genou Oil & Gas Company's discovery well of 30 barrels per day. The oil is coming from a 72 foot sand at 1445 feet. Four new wells are spotted for immediate drilling on the new structure. Speer-Craig-McCutcheon interests (Genou Oil & Gas Company) will drill on the northeast quarter of section 8-25-1e; Big West Oil Company on section 7-25-1w; Fidelity Oil Company on the Bannatyne ranch, southeast of the discovery; Brittan-DeSchon interests will drill on section 34-26-1w. All of these new tests are wells enough scattered to make their locations of much importance in determining the extent of the producing area and the general trend of structural conditions.

Royal Canadian Oil Company of New York will resume operations on its Kevin-Sunburst holdings after a year of inaction. Well on the Fred McGowan permit will be put on the pump and contract will be let for two new wells to W. E. Burks.

R. S. Lord, president of the Hope Engineering & Supply Company of Youngstown, Ohio, visited in Great Falls last week for the purpose of surveying possibilities for the laying of a gas line from Kevin-Sunburst field to this city. Mr. Lord came into Montana on the request of the Northern Natural Gas Development Company which has already developed 85,000,000 of the 100,000,000 cubic feet of gas necessary before the line could be considered.

Rio Blanco County Gasser Makes 40,000,000 Feet

Denver, Colo. — Texas Production Company is reported to have completed a 40,000,000 cubic foot gas well in Rio Blanco County, Colorado. It is the company's Rangely 2. After the bit had entered a dark brown sand, below the Morrison formation, at 3500 feet, the gas was encountered; it is coming from a horizon 500 feet lower than gas found in other wells in the same locality.

Warm Springs Wells Being Put on Production

Thermopolis, Wyo.—Oil wells in the Warm Springs field, east of this town, are being produced and the oil is being shipped to the LeMont Refining Company at LeMont, Illinois. This refinery is owned by the C. B. Shaffer intersts of Chicago. There is a report to the effect that all of the wells in the field will be revamped and the production of the field after this is done will be about 300 barrels.

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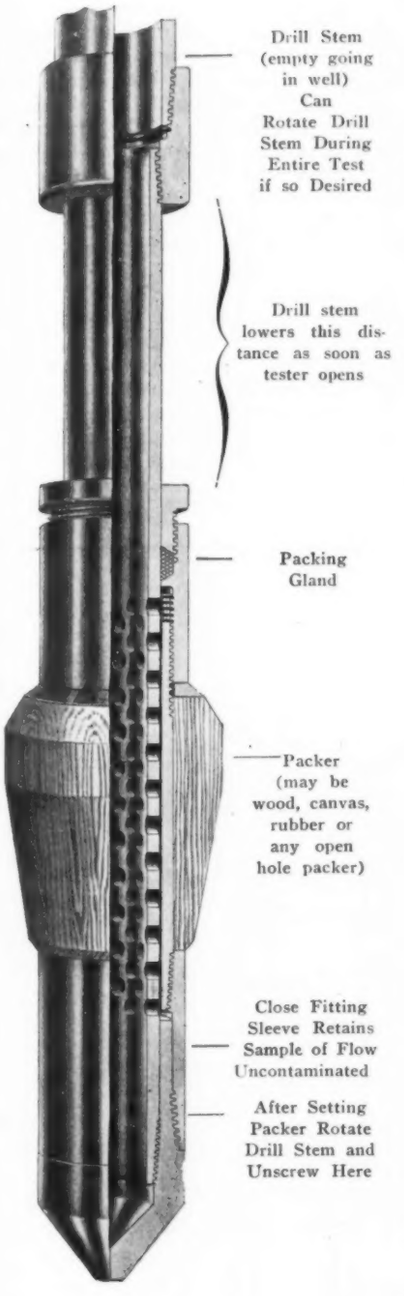
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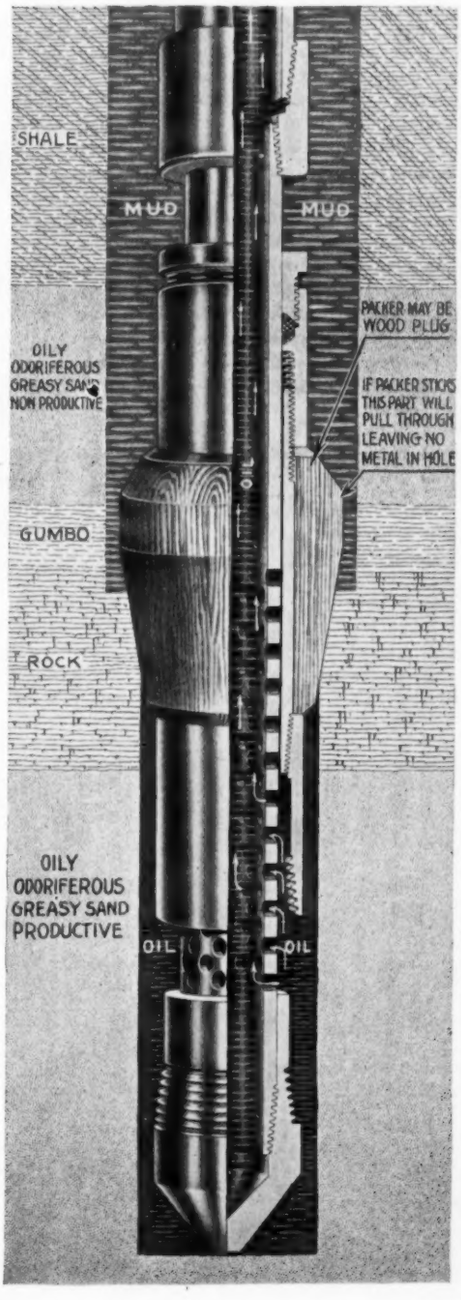

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Stratigraphic Position of the Big Lime Of West Texas*

By EVERETT C. EDWARDS

Geologist for the Exploration Company of Texas, 303 Mays Bldg., San Angelo, Texas

THE economic importance of West Texas needs no introduction to the oil industry.

Structurally, West Texas is a large geosyncline. Detailed studies of the stratigraphy of this area have been made along the truncated outcrops of the Permian measures around the periphery of this geosyncline. These studies have been made public in state and federal bulletins, but thus far very little has been published about the stratigraphy of the Permian basin proper, that extensive area where oil and potash are found, and where the Permian is concealed by Mesozoic and later systems.

*Read before the Association at the Tulsa meeting, March 26, 1927. Manuscript received by the editor April 4, 1927. Reprinted from the Bulletin of the American Association of Petroleum Geologists.

The area described in this paper lies between 100 degrees and 105 degrees West Longitude, south of the Panhandle, and north of the Marathon Mountains.

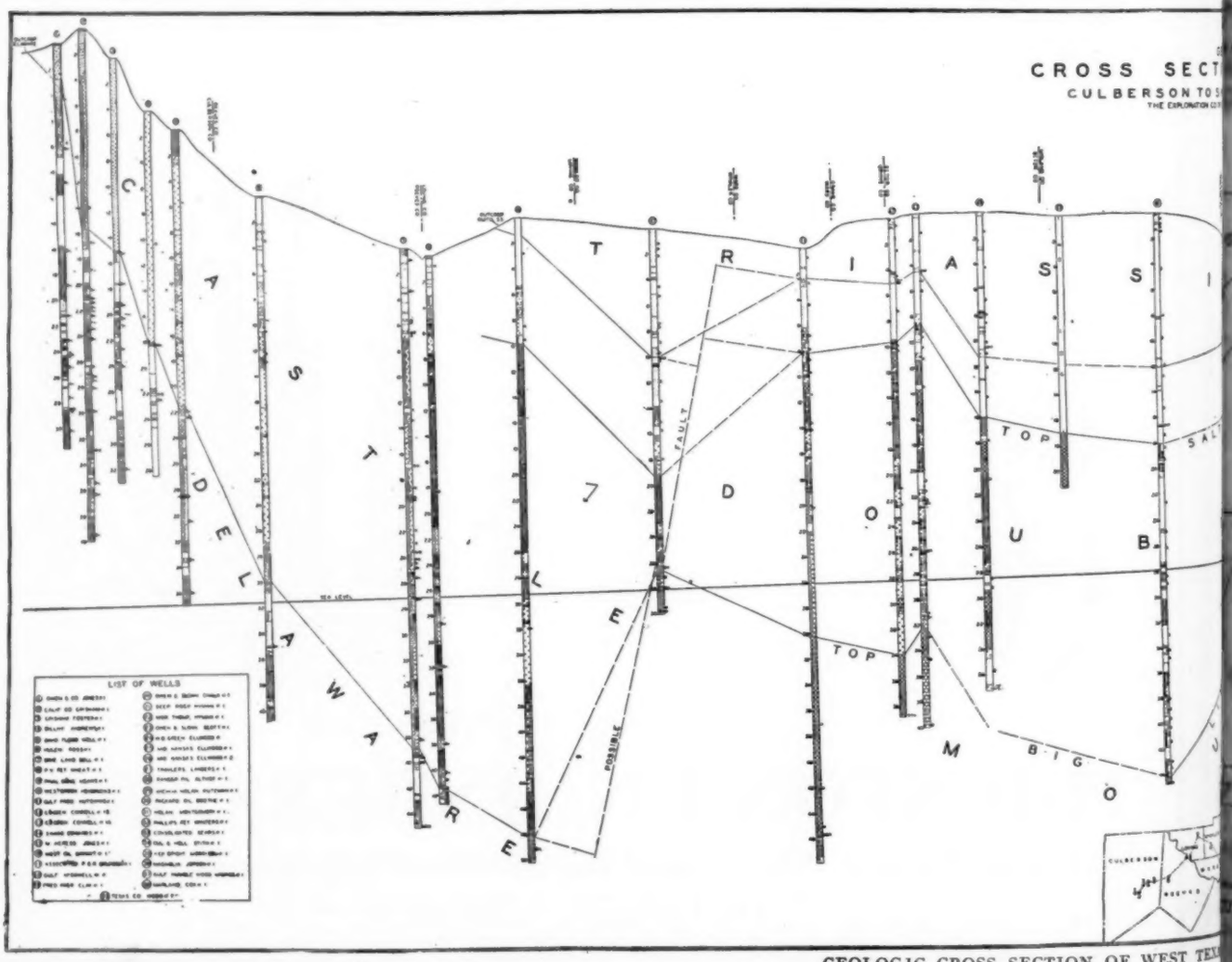
The position of the Big Lime in the stratigraphic column is important because it is a blanket deposit underlying most of west Texas, and is the key bed most frequently used for subsurface control. Because of its wide areal distribution, it gives promise of serving as the key formation common to all of the separated districts.

General Structure

As mentioned in the introduction, the structure of west Texas is that of geosyncline. The eastern margin is defined by the Bend Arch. The southern margin may be considered as a line extending from the Marathon Mountains to the central mineral region, or Llano uplift. The western side is limited by the mountains of southeastern New Mexico and the Delaware and the Apache mountains of Texas. The granite ridges of the Panhandle district, and the Ancestral Rocky Mountains of New Mexico may be taken as the northern limit. The area within these limits appears to be one big geosyncline comprising a geologic province.

Basin of Deposition

This area in west Texas, which is at present a structural geosyncline, during the Permian period was a basin of deposition. This fact is important because the stratigraphic sections in different parts of the basin are definitely related to such factors as Permian land masses, strand lines, and marine areas.



GEOLOGIC CROSS SECTION OF WEST TEX

ABSTRACT

Rapid oil developments in West Texas make necessary an interdistrict correlation for the petroleum geologist.

Geologically, West Texas is a structural geosyncline, and during Permian times it was a basin of deposition.

The Permian sea invaded from the southwest. Clastic sediments were derived from ancient Llanoria, from the Wichita Mountains, the igneous ridges of the Panhandle, and from the Ancestral Mountains of New Mexico. This material formed a border of red clastic sediments around the landward portion of the Permian sea, which, traced seaward in directions normal to the strand lines, grades into marine sediments, chiefly dolomitic limestones.

The latter constitute what is called the "Big Lime" series. The top of the Big Lime is the key bed used in subsurface work in West Texas. The upper part of the Big Lime is found to be of Double Mountain age, and may correlate with the Word formation of the Glass Mountain area and the Delaware formation of the Trans-Pecos area. It is considerably higher stratigraphically than the Big Lime of the Panhandle district.

Following the deposition of the Big Lime, a closed or restricted basin developed the result being that the upper Permian measures are composed chiefly of anhydrite and salt, deposited from super-saline water.

The ancient land, Llanoria, which lay south and east of the area under discussion, and which was a land mass from pre-Cambrian until Cretaceous times, contributed the greater part of the clastic material found in the Permian series of west Texas.

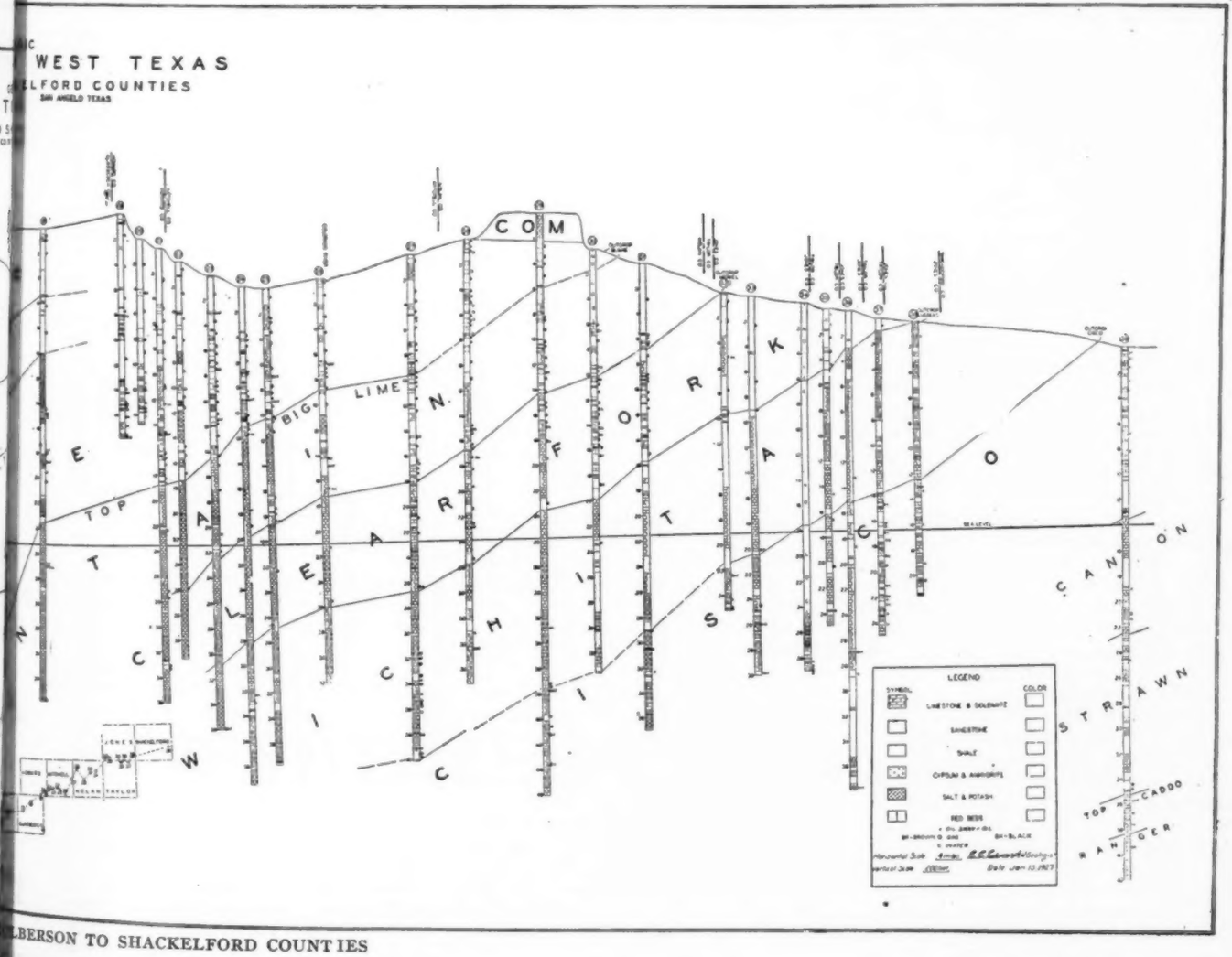
General Stratigraphy, East Side of the Basin

Along the east side of the basin, immediately west of the Bend Arch, the truncated outcrops of the Permian strata have been studied and described. They have been subdivided into three formations: The Wichita-Albany, the Clear Fork, and the Double Mountain (Fig. 1).

The Wichita-Albany formation is the lowest. It is typically a marine deposit, consisting chiefly of dolomitic limestone and blue shale, with some sandstone, principally at the base. It represents the farthest invasion of the Permian sea over the area previously occupied by the Pennsylvanian. There is no marked structural or depositional break between the Pennsylvanian and the Permian. The only noticeable contrast is that the Cisco contains considerable red sand and red shale, indicating transportation and deposition of clastic material from adjacent land masses. In the succeeding Wichita-Albany epoch, the adjacent land masses must have had very little relief, because the sediments are practically all of the marine type. The Wichita-Albany formation is about 1200 feet thick.

Overlying the Wichita-Albany is the Clear Fork, which is a mixed continental and marine deposit. Except for a small amount of dolomite and blue shale, the Clear Fork outcrop consists entirely of red sandstone and red shale. It is 900-1000 feet thick.

Above the Clear Fork is the Double Mountain formation. At the outcrop this consists of red sandstone, red shale, and gypsum. The entire thickness of the Double Mountain group cannot be measured along the outcrop, because it dips constantly westward, passing under the Mesozoic and later systems. Its total thickness can only be obtained from logs of wells drilled



ALBERSON TO SHACKELFORD COUNTIES

FIG. 1.—MAP OF WEST TEXAS SHOWING FORMATION BOUNDARIES AND LINE OF CROSS-SECTION.

in the center of the basin. From this source of information its maximum thickness may be given as more than 4000 feet. There it is composed of red sandstone and shale, anhydrite, salt, polyhalite, and dolomitic limestone.

Position of the Big Lime on the East Side

From their outcrops, these formations have been traced underground into the basin by comparison of the logs and samples of the intervening wells. As shown in the accompanying cross-section, the lithology at the outcrop is radically different from the lithology of these same formations as logged in the wells. The one exception to this is the Wichita-Albany formation, which preserves a marine facies throughout its entire extent, as represented in this area.

Although the Clear Fork consists almost entirely of red clastic material on the truncated outcrop, it has graded laterally into a dolomitic limestone in the basin proper. This is due to the fact that the clastic material has thinned out and disappeared in a seaward direction, and its place in the stratigraphic column has been taken by typical marine deposits.

During the lower Double Mountain epoch the same processes of deposition continued which were operative during the Clear Fork. The red beds of the Double Mountain, as high up as the Blaine gypsum formation, have graded out to the west, their place being taken by marine calcareous deposits which form the Big Lime.

During the Clear Fork and lower Double Mountain epochs, the adjacent land mass to the east was evidently rising intermittently, each new uplift causing a flood of red clastic material to be thrown into the Permian sea along the shore. The occasional uplifts resulted in the deposition of extensive wedges of clastic material, which gradually thin out and disappear toward the west, far out in the basin. They are separated from each other by deposits of dolomitic lime and blue shale, which conversely wedge out and disappear toward the east. The wedges of red beds are very helpful in unraveling the correlation of the east side of the basin. They are easily detected and are usually logged by the driller. Their alignment in the different wells can be used as a gauge to show the correlation and rate of dip of those formations which are less recognizable.

Three definite wedges of red beds can be named. One occurs at the base of the Clear Fork, one in the middle of the Clear Fork, and one at the base of the Double Mountain formation, the latter occuying the stratigraphic position of the San Angelo conglomerate of Texas and the Duncan sandstone of Oklahoma. A cross-section, if drawn along a line parallel to the strand lines, would illustrate that the lithology is practically the same throughout the entire distance.

The top of the Big Lime, when projected to the outcrop, is found to be at the base of the Blaine gypsum formation, and is about 700 feet above the Merkel dolomite. Therefore it can be placed definitely within the Double Mountain formation.

Top of the Big Lime in the Basin

In the basin no limestone formations are found above the top of the Big Lime. It is overlain by red beds, anhydrite, and salt.

Salt has not been encountered below the top of the Big Lime in any of the wells drilled thus far.

The appearance of thick formations of salt and anhydrite in the stratigraphic column indicates that the conditions of deposition had undergone a decided change. The anhydrite and salt must have been laid down in a closed, semi-closed, or restricted basin. It seems logical to assume that the contact between the Big Lime series and the overlying anhydrite and salt series marks the time of the restriction of the Permian sea. This assumption will be used later in discussing the probable stratigraphic position of the Big Lime on the west side of the basin. Its importance is substantiated by the fact that at the end of the deposition of the Big Lime, certain deformative movements took place, which affected the lime, but not the overlying beds.

It is not everywhere an easy task to locate the contact between the two series. In places the break is distinct. Elsewhere there is a transition zone present through which the anhydrite grades imperceptibly into dolomitic limestone. In places small amounts of anhydrite are found below the top of the lime. In the basin proper, the top of the lime cannot be determined from drillers' logs. Most drillers log anhydrite as lime. This means that the contact between the two series must be obtained from an examination of samples taken from the wells.

Where it is difficult to place the contact, adjacent beds may be used as checks. There are the brown sandy dolomite, the white lime, the bentonite horizons, the sulphur-water zone, and others. In practically all cases the lime is overlain, first by anhydrite, and then by salt.

It is thus seen that the change in depositional conditions in the basin was gradual rather than sudden.

The Big Lime of West Texas and the Big Lime of the Panhandle District

The conditions of lithology and deposition represented in the eastern part of the cross-section are somewhat similar to the conditions south of the Panhandle.

The Big Lime of the Panhandle appears to be Wichita. A short distance to the south, the first lime encountered by the drill is Clear Fork. From Dickens County south and west, and including that county, the uppermost lime is the Big Lime of west Texas.

It might be of interest to mention that in the Panhandle district the Blaine gypsum formation caps the salt series, although in west Texas part of the salt series overlies the Blaine gypsum.

The West Side of the Basin

On the west side, in the vicinity of the Delaware Mountains, the Permian has been divided into the Delaware, Castile, Rustler, and Capitan formations.

The Delaware formation is a dark carbonaceous sandy limestone ranging from 2000 to 4000 feet thick. It is marine.

The Castile formation is composed of 2000 or more feet of anhydrite and gypsum, resting apparently conformably upon the Delaware formation, the contact being a 30-foot bed of brown sandstone.

The Rustler formation is a thin dolomitic limestone bed about 200 feet thick, occurring at the top of the Castile.

The Capitan formation consists of 2000 feet or more of dolomitic limestone, which also appears to lie conformably upon the Delaware forma-

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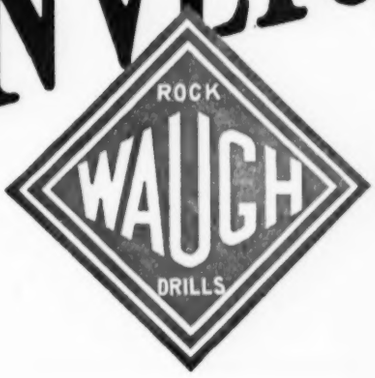

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tion. It outcrops in the mountains west of the area underlain by the Castile gypsum, and has been correlated with the Castile by most of the petroleum geologists who have studied the Trans-Pecos area.

In New Mexico, in the Artesia field, the stratigraphic section of the Permian, as shown by cuttings from the wells drilled in the field, is as follows: approximately 2000 feet of gypsum and anhydrite containing red clastic material and some dolomitic limestone, below which the section is light and dark sandy dolomitic limestone. South of the Artesia field, in the Guadalupe Mountains, the Permian stratigraphic column has been subdivided into the Delaware, the Capitan, and the Carlsbad limestone.

On the southwest side of the basin, in the Glass Mountains, the following subdivisions have been made, from bottom to top: Wolfcamp, Hess, Leonard, Word, Vidrio, Gilliam, and Tessey. These formations consist for the most part of dolomitic limestone, containing sandstone and shale. The formations are fossiliferous and appear to be marine deposits throughout. They have a total thickness of about 7000 feet.

Correlation of the Big Lime With the West Side

On paleontological evidence the Word formation of the Glass Mountanis section has been correlated with the Delaware formation of the Trans-Pecos region.[1] Both are considered to be of Double Mountain age. Lithologically, they are somewhat similar. The Word formation is overlain by the Vidrio, which very closely resembles the Capitan of the Trans-Pecos region. They probably are to be correlated.

The correlation of southeastern New Mexico with the Trans-Pecos area and the Glass Mountains is still a moot question. Inasmuch as it may eventually furnish the key to the problem of the correlation of the Big Lime of the basin with the section on the west side, it is relevant to this paper.

In this paper it will be impossible to discuss all of the ideas which are being advanced regarding the correlation of the Permian strata on the west side of the basin. Some of the conflicting views and the various arguments given in support of them may be summarized as follows:

1. The Big Lime, the Delaware, the Word, and the Artesia "pay" correlate.

a) All of these formations are of Double Mountain age. This correlation is based on fossil evidence and subsurface correlation.

b) An extension of the strike of the contours of the Delaware formation from Texas into the Artesia field causes them to coincide with the contours on the pay zone of the latter. If the two do not correlate, a fold or fault of considerable magnitude would be necessary to explain the discrepancy.

c) These formations are similar lithologically, containing beds of bentonite near the top, and beds of dark sandy limestone. Such differences in lithology as are present may be explained by changes of facies. The correlation of the Delaware and the Word appears to be acceptable to all, although the difference in lithology between these two is about as great as between the Delaware and the Big Lime.

d) Within the basin, the contact between the lime series and the overlying salt and anhydrite series should be used as a time equivalent, because of the genetic significance of the two types of deposits.

2. The Big Lime and the Artesia pay are above the Delaware and Word formations. They correlate with the Capitan formation, and with part of the anhydrite and salt series.

a) West Texas may not have been one salt basin, but two or more during the Permian, and the Big Lime of one locality may correlate with the salt and gypsum of another.

b) The most concentrated salt solution may have settled into the deeper parts of the Permian basin, precipitating salt and anhydrite, while dolomitic lime was being deposited contemporaneously in the shallower portions of the sea.

c) Salt and anhydrite may have been

[1] J. A. Udden, "Notes on the Geology of the Glass Mountains," University of Texas Bulletin No. 1753 (1920), p.50.

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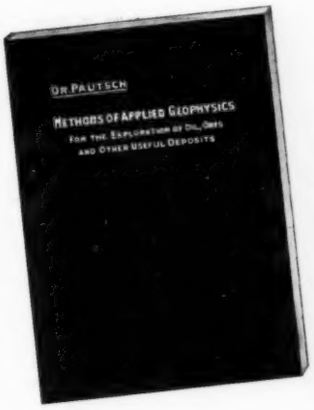

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precipitated in the shallowest parts of the Permian sea, where evaporation may have been greatest, while dolomitic lime was being deposited contemporaneously in the deeper portions, subsidence keeping pace with deposition.

d) Samples taken from drilling wells indicate that the Big Lime of west Texas and of New Mexico bears a closer resemblance to the Capitan than to the Delaware formation.

3. The Big Lime of west Texas and of New Mexico correlate with the Capitan, being above the Delaware formation and below the Castile gypsum.

a) The Castile lies unconformably upon the Delaware.

b) The Castile lies unconformably upon the Capitan.

c) Samples from the wells show that the Big Lime resembles the Capitan and not the Delaware.

d) Where the Castile gypsum directly overlies the Delaware formation, the Big Lime series has been removed by erosion.

Conclusion

These are only some of the current opinions which are in active circulation concerning the correlation of the Big Lime series with the type sections on the west side of the basin. The writer at the present time favors the first hypothesis, but realizes that more information is needed before a final correlation can be made. As in all current discussions about west Texas, the conclusion is that more drilling must be done before a final correlation of the west side of the basin can be made.

Minneapolis Interests Plan Extensive Montana Tests

Great Falls, Mont.—Some of the leases in Devil's Basin field which belong to the defunct Van Duzen Oil Company have been taken over by Shoshone Consolidated Oil Company of Minneapolis. The latter company plans to drill on six structures in Montana, and has already contracted for a 5500 foot test on Hamilton Dome near the town of Big Timber.

Abandon Operations on Red Mesa in Colorado

Denver, Colo.—Exploration for oil and gas for the present has been finished in the territory between Durango and the New Mexico line, by the suspension of operations at Hutchinson 1 of the Miley Exploration Company, section 32-33-12, Red Mesa. Total depth is 3653 feet where the bit ran into salt water. For several years tests have been under way in this district, many of them having encouraging showings of gas and oil.

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Oklahoma Iron Works to Resume Dividends

Tulsa.—At a special meeting of stockholders of the Oklahoma Iron Works here last week it was voted to resume the payment on dividends on the stock, dividends to be on the annual basis of six per cent, payable quarterly, beginning October 15 to stockholders of record October 1.

J. W. Sloan is president of the Oklahoma Iron Works and also the head of International Supply Company, a subsidiary of the Iron Works. R. P. Sharp is vice-president and A. F. Bourne is secretary and treasurer, respectively, of the two concerns.

Camarillo, Calif.—The Standard Oil Company has failed in its effort to make an oil well from its Camarillo 1, near this place. The well was drilled to 5470 feet and a string of 4¾-inch casing landed on bottom for the test. The casing was cemented through perforations at 5240 feet. A very small amount of oil was produced but the well was far from commercial. The test probably will be deepened.

San Bernardino, Calif.—The Summit Oil Company has started a well on section 20-3-5, near Summit, and will use a special hydraulic drill, the invention of a California man, on the test. A heavy electric motor will furnish the power. The test will be a wildcat in every respect, since the nearest production is more than 35 miles away.

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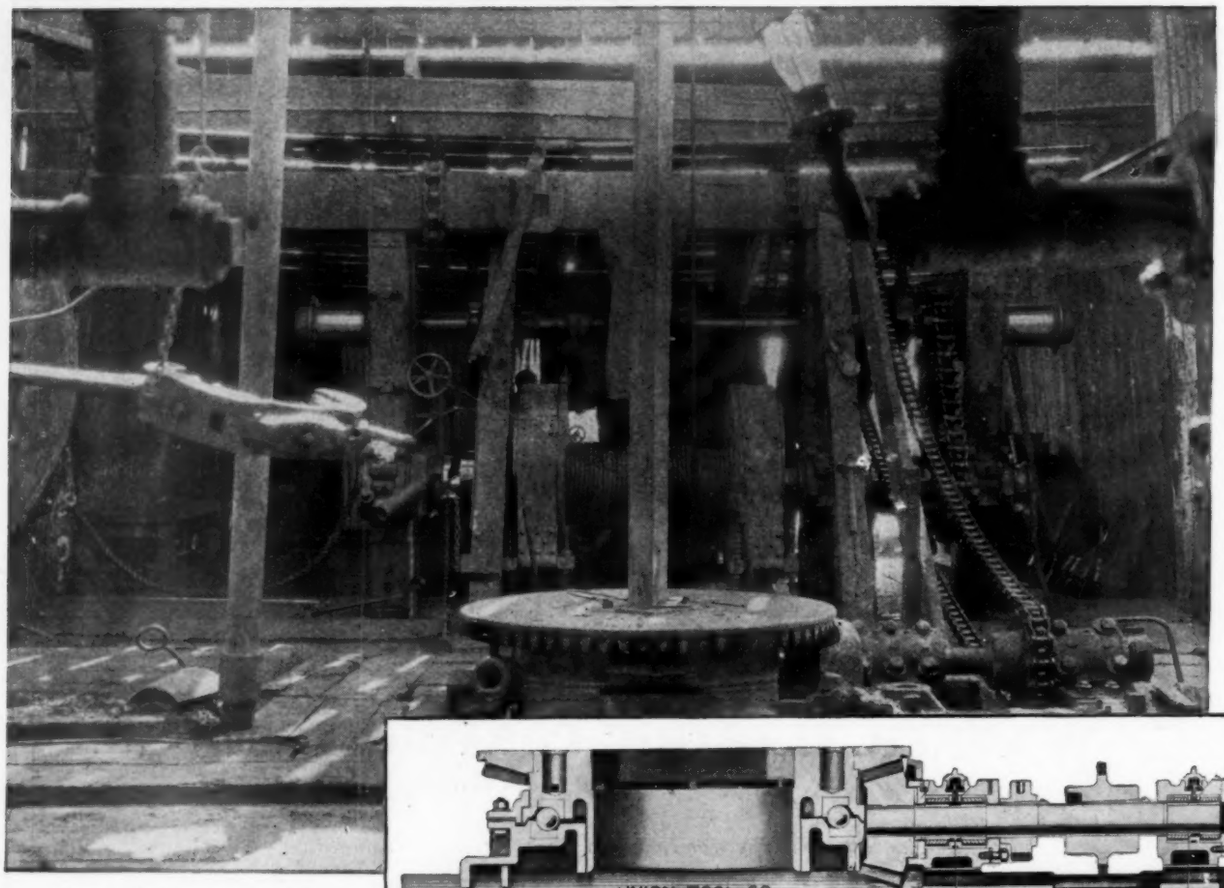

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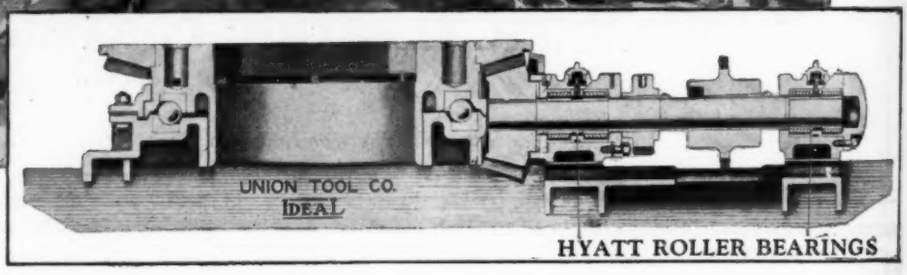

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